Article

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Effectiveness of Belimumab in the Treatment of Systemic Lupus Erythematosus and Its Impact on Improving the Quality of Life of Patients

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Objective: To analyze the efficacy of belimumab in the treatment of systemic lupus erythematosus (SLE) and its effect on improving the quality of life of Chinese patients.

Methods: A retrospective study was conducted using the medical records of 52 SLE patients admitted between March 2021 and April 2022. These patients were divided into two groups: the control group and the monoclonal antibody group, with 26 cases in each group. Patients in the control group received standard SLE treatment, while those in the monoclonal antibody group received standard SLE treatment in addition to belimumab therapy. The clinical treatment effect, dosage of hormone drugs, SLE disease activity index (SLEDAI) score, peripheral blood B cell level, 36-item Short Form health survey questionnaire (SF-36) and adverse reactions before and after treatment were compared between the two groups.

Results: The routine treatment plus belimumab resulted in higher efficacy than routine treatment alone ($p < 0.05$). The routine treatment plus belimumab led to a lower B cell as compared to the routine treatment alone ($p < 0.05$). The routine treatment plus belimumab was associated with higher quality of life ($p < 0.05$). The safety profiles of the two groups were similar ($p > 0.05$).

Conclusion: Belimumab might be a viable strategy in the treatment of Chinese patients with SLE. Belimumab can significantly reduce the dosage of hormone drugs in patients, and effectively reduce the SLEDAI score and peripheral blood B cell level of patients, and is not linked to adverse reactions. Therefore, it is worth promoting widely.

Keywords: belimumab; systemic lupus erythematosus; effective value; quality of life; SLEDAI score; B-cells

Introduction

Systemic lupus erythematosus (SLE) is an autoimmune disease in which a variety of autoantibodies are produced due to dysfunction of immune regulation, causing damage to multiple organ systems [1]. The clinical manifestations of SLE include fever, rash, oral ulcers, photosensitivity reaction, and joint inflammation [2]. Due to the insidious early symptoms of SLE, the patients might be gravely ill at the time of diagnosis [3]. Though timely and effective therapeutic intervention for SLE patients can slow disease progression [4], at present, there is no cure for SLE. Glucocorticoids and immunosuppressants are used routinely to treat SLE [5]. The dosage of these drugs is dynamically adjusted according to the patient's disease activity. Hydroxychloroquine is used in combination with glucocorticoids as a long-term medication strategy for SLE [6]. Additionally, immunosuppressants, such as azathioprine, cyclosporine, and tacrolimus, may be considered for patients who exhibit a poor response to glucocorticoids in conjunction with hydroxychloroquine [7]. Nevertheless, given the adverse events associated with the above drugs and the drug intolerance developed by some patients, it is often not feasible for patients to adhere to the routinely-prescribed medication for a long time. Irregular medication or discontinuation without authorization may further aggravate the disease, and negatively affect the patient's prognosis [8]. Meanwhile, the long-term use of glucocorticoids may lead to hypertension, diabetes, electrolyte disorders, and other diseases. Immunosuppressants increase the risk of infection, further aggravating the disease [9,10].

Belimumab is the first (Food and Drug Administration) FDA-approved targeted biological agent for the treatment of SLE. Belimumab is a fully humanized IgG1-λ monoclonal antibody which binds to B-cell activating factor (BAFF) and inhibits B-cell activity [10]. It minimizes the risk of organ damage by inhibiting the activation of B-cells in patients with SLE and reducing the production of autoantibodies in patients [11]. Moreover, belimumab also inhibits the proliferation and differentiation of B-cells and

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induces autoimmune B-cell apoptosis by targeting BAFF, thereby improving clinical symptoms, reducing the activity of SLE, and allowing to reduce the dosage of glucocorticoids, bringing hope for the effective control of SLE [5,12,13]. At present, several large multi-center clinical trials on belimumab in the treatment of SLE (such as BLISS-52, BLISS-76, BLISS-SC and BLISS-Northeast Asia) have shown that belimumab is safe and efficacious [14–17]. Belimumab approval for the treatment of SLE has been obtained in Japan, the United States, and other countries, and its efficacy and safety have been confirmed in multiple studies [18]. However, its efficacy and safety in the treatment of SLE in China have not been determined. In light of this, the present study was conducted to analyze the efficacy of belimumab in the treatment of SLE and its ability to improve the quality of life for Chinese patients with SLE.

Participants and Methods

Baseline Data

A retrospective study was conducted using the medical records of 52 SLE patients admitted between March 2021 and April 2022. These patients were divided into two groups: the control group and the monoclonal antibody group, with 26 cases in each group. Patients in the control group received standard SLE treatment, while those in the monoclonal antibody group received standard SLE treatment in addition to belimumab therapy. This study has been approved by the Ethics Committee of Shiyan Hospital of Integrated Traditional and Western Medicine, Ethical Approval Number: SY3287119.

Inclusion and Exclusion Criteria

Inclusion criteria: (1) All patients were confirmed to have SLE by clinically relevant diagnostic results; (2) All patients had no allergic reaction to the drugs used in this study; (3) All patients had no abnormality in organ function tests; (4) All patients voluntarily signed the relevant informed consent.

Exclusion criteria: (1) Patients had severe active central nervous system lupus, severe active lupus nephritis, etc.; (2) Patients had other serious infectious diseases; (3) Patients had mental illness or family history of mental illness; (4) Patients have malignant tumors, whether they currently have malignant tumors or have a history of malignant tumors; (5) Patients and their families had no ability to fully cooperate with this study. Furthermore, to ensure the effectiveness of the study, the baseline SLE disease activity index (SLEDAI) scores for eligible patients must fall within a specific range, with the following requirements: Patients must have a baseline SLEDAI score greater than 5 to ensure a certain level of disease activity during the study. Additionally, it should be noted that there is an upper limit for the SLEDAI score, and patients with scores above this limit will not be included in the study.

Methods

(1) The patients in the control group were given standard SLE treatment: prednisone acetate tablets (Tianjin Xinyi Jinjin Pharmaceutical Co., Ltd., H31020675, Tianjin, China) were given orally, with an initial dose of 5–50 mg/d; hydroxychloroquine sulfate tablets (Shanghai Shangyao Chinese and Western Pharmaceutical Co., Ltd., H19990263, Shanghai, China) were given orally, 0.4 g/d; tacrolimus capsules (Sinopharm Chuankang Pharmaceutical Co., Ltd., H20083943, Chengdu, China) were given orally, 1 mg/d.

(2) The patients in the monoclonal antibody group received the same oral treatments as control group patients, in addition, they received belimumab (GlaxoSmithKline Manufacturing SPA., S20190032, Brentford, UK) 10 mg/kg, initially, once every two weeks for six weeks. Then they received the same treatment once every four weeks. Both groups of patients were treated for six months.

Outcomes

(1) Clinical effectiveness. Effectiveness was assessed according to the improvement of symptoms and signs after treatment and the performance of SLE disease activity index (SLEDAI) [19]. Markedly effective: after treatment, the patient's body symptoms and signs basically disappeared, with SLEDAI score less than 5 points; effective: after treatment, the patient's body symptoms and signs were significantly mitigated, with SLEDAI score was 5–14 points; ineffective: no significant mitigation was observed in symptoms and signs compared with those before treatment, with SLEDAI score was more than 14 points.

(2) Dosage of glucocorticoids. The doses of hormone drugs used by patients before and after treatment were recorded by the relevant medical staff in our hospital.

(3) SLEDAI [19]. Before and after treatment, the SLEDAI score was employed to assess disease severity. The scale involves 24 indices of 9 organ systems, with a total possible score of 105 points, and a higher score indicating a more severe condition.

(4) Level of B cells in peripheral blood. Before and after treatment, 5ml of venous blood was drawn from patients, and PBMCs were extracted by gradient density centrifugation, and then B cells were isolated. Flow cytometry (BD Accuri™ C6 flow cytometer, BD Biosciences, Franklin Lakes, NJ, USA) was used to determine the level of B cells in peripheral blood of patients.

(5) A 36-item Short Form health survey questionnaire (SF-36) was employed before and after treatment [20]. Patient responses are quantified and converted into eight separate domains (physical functioning, role limitations due to physical problems, role limitations due to emotional problems, energy and fatigue, emotional well-being, social functioning, pain, general health status), with a total score of 0–100 points. Higher score indicates a higher quality of life.

Table 1. Comparison of baseline data [$\bar{x} \pm s$, n (%)].

	Control group (n = 26)	Monoclonal antibody group (n = 26)	t/χ^2	p
Gender			0.082	0.773
Male	9	10		
Female	17	16		
Age (years)	14–57	13–56		
Mean age (years)	35.62 ± 10.14	35.48 ± 10.09	0.049	0.96
Course of disease (years)	1–24	1–21		
Mean course of disease (years)	9.86 ± 5.29	9.76 ± 5.31	0.068	0.946
Educational background			0.746	0.387
High school and below	18	15		
College and above	8	11		

Table 2. Comparison of clinical effectiveness [n (%)].

Groups	n	Markedly effective	Effective	Ineffective	Total effectiveness (%)
Control group	26	7	11	8	69.2% (18/26)
Monoclonal antibody group	26	11	14	1	96.2% (25/26)
χ^2	-	-	-	-	4.837
p	-	-	-	-	0.027

(6) Adverse reactions. The possible adverse reactions of patients during treatment include infection, fever, nausea and vomiting.

Statistical Analysis

SPSS 22.0 (IBM Corp., Armonk, NY, USA) was used to organize and analyze the data. Data were expressed as mean ± standard deviation ($\bar{x} \pm s$). Statistical analysis was performed using the independent two-tailed Student's *t*-tests for comparing two variables with a significance level of 0.05. Enumeration data were expressed as number of cases (rate), and chi-square was used to test enumeration data. GraphPad Prism 8 (GraphPad Software Corporation, Los Angeles, CA, USA) was used for graphics rendering.

Results

Baseline Data

The baseline parameters of the two groups of patients were balanced ($p > 0.05$) (Table 1).

Clinical Efficacy

Overall, the routine treatment plus belimumab resulted in higher efficacy than routine treatment alone ($p < 0.05$) (Table 2).

Hormonal Drug Dosage, SLEDAI Score and Peripheral Blood B Cell Level

As shown in Fig. 1. Collectively, the dosage of hormonal drugs, SLEDAI score and peripheral blood B cell level had no difference in the two groups preoperatively ($p > 0.05$), and the routine treatment plus belimumab led to a lower dosage of hormonal drugs, SLEDAI score and B cells as compared to the routine treatment alone ($p < 0.05$).

36-Item Short Form Health Survey Questionnaire (SF-36)

As shown in Fig. 2, Preoperatively, there was no significant difference in the quality of life between the two groups ($p > 0.05$); and the routine treatment plus belimumab was associated with higher quality of life ($p < 0.05$).

Adverse Reactions

The safety profiles in the two groups were similar ($p > 0.05$) (Table 3).

Discussion

SLE, also known as an immortal cancer clinically, has the characteristics of long disease course and easy recurrence [21], and is associated with a series of adverse reactions in the blood system, such as hemoglobin reduction, leukopenia, thrombocytopenia, and anemia, immensely interfering with quality of life, and being life-threatening in severe cases [22–24]. Early detection and immediate intervention after diagnosis are essential. The key for treatment is to reduce the disease activity in a timely manner to improve the patient's quality of life [25]. Relevant studies indicate that the pathogenesis of SLE is mainly the survival of autoreactive B cells promoted by the loss of tolerance and defective B lymphocytes. It has been suggested that the use of B lymphocyte depletion therapy can effectively delay SLE [26].

Previously, SLE patients were often treated with glucocorticoids, immunosuppressants and other drugs. Despite the incurability of SLE, they can effectively attenuate the clinical symptoms of patients and delay disease progression [27]. However, in recent years, increasing numbers of

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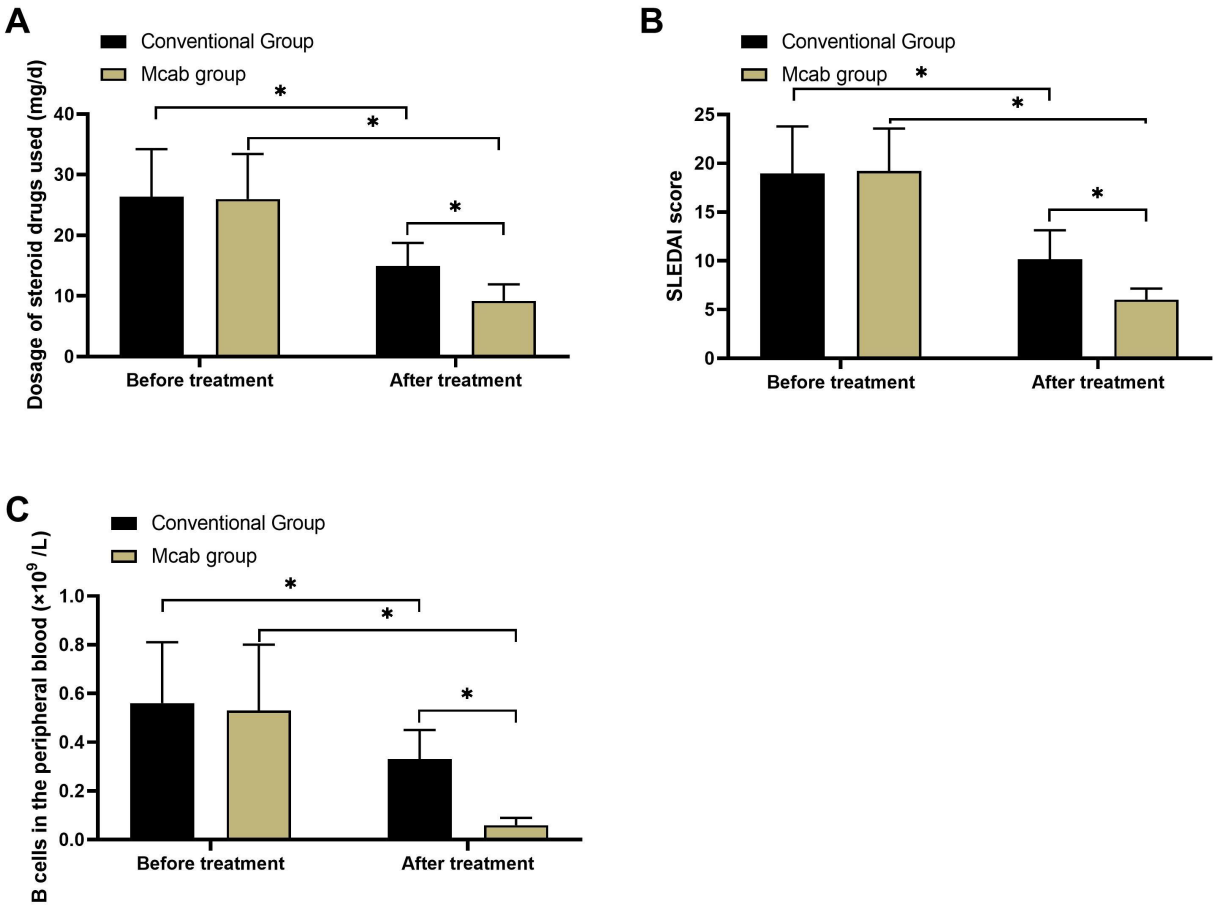

Fig. 1. Comparison of hormone drug dosage, systemic lupus erythematosus (SLE) disease activity index (SLEDAI) score and peripheral blood B cell level ($\bar{x} \pm s$). (A) Dosage of steroid drugs used. (B) SLEDAI score. (C) B cells in the peripheral blood. Note: * means $p < 0.05$.

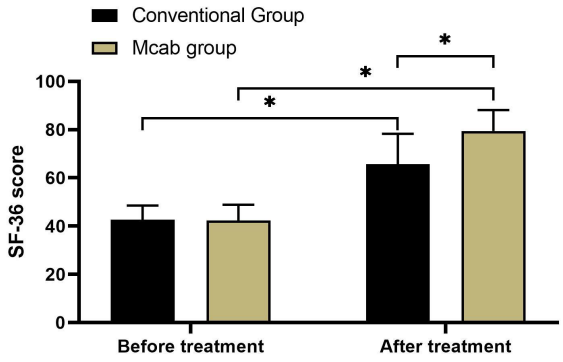

Fig. 2. Comparison of quality of life (SF-36) levels ($\bar{x} \pm s$). Note: * means $p < 0.05$. SF-36, 36-item Short Form health survey questionnaire.

clinical studies indicated that the use of glucocorticoids, immunosuppressants and other drugs is associated with poor results, and the long-term efficacy particularly the quality of life can be unsatisfactory [28,29]. Belimumab is approved for the treatment of SLE. It is one of the fully human IgG1 monoclonal antibodies and has binding and neutralizing effects on BAFF in the human body [16,30]. BAFF binds to the receptor, thereby inhibiting the differentiation, maturation and antibody secretion of B cells, inducing apoptosis, and mitigating their related clinical symptoms [31,32]. As previously noted, belimumab can significantly reduce the use of glucocorticoids, immunosuppressants and other drugs in patients, thereby reducing the adverse reactions caused by these drugs, and delaying disease progression [12,33,34].

Though extensive evidence has confirmed that belimumab exhibits ideal effectiveness and good safety profile in SLE patients, there is a paucity of studies on belimumab in the treatment of Chinese patients with SLE [35]. The findings of the present study showed that routine treatment plus belimumab resulted in higher efficacy than routine treatment alone, and routine treatment plus belimumab led to a lower B cell as compared to routine treatment alone, and routine treatment plus belimumab was associated with a higher quality of life. All these findings were consistent

Table 3. Comparison of adverse reactions [n (%)].

Groups	n	Infection	Fever	Nausea and vomiting	Total incidence (%)
Control group	26	0	1	2	11.5% (3/26)
Monoclonal antibody group	26	1	2	1	15.4% (4/26)
χ^2	-	-	-	-	0.00
p	-	-	-	-	1.00

with the results of Brunner [34]. B cell activator is a secreted cytokine in the TNF family, which acts directly on the proliferation and differentiation of B cells. Moreover, it can bind to a variety of B cell membrane receptors, thereby increasing the level of autoantibodies and inducing SLE disease-related symptoms [36]. As a specific inhibitor of B lymphocyte stimulator, belimumab directly reduces the degree of activation of naive B cells, transitional B cells, etc., and ultimately reduces the level of related indicators of B cell activation [17]. It is the fundamental reason that it can reduce the dosage of hormonal drugs and improve the quality of life of patients and SLE disease activity. Additionally, safety profiles were similar in the two groups.

The study is limited by a small sample size. In the future, we will address these limitations by improving the study design, which includes increasing the number of enrolled patients to enhance the reliability of our study conclusions. Additionally, we are eager to participate in larger, higher-quality multicenter clinical studies to further advance our research.

Conclusion

The present study indicates that belimumab might be a viable strategy in the treatment of patients with SLE. The drug can significantly reduce the dosage of hormone drugs in patients, and effectively reduce the SLEDAI score and peripheral blood B cell level of patients, and is not linked to adverse reactions. Therefore, it is worth promoting widely.

Abbreviations

SLE, systemic lupus erythematosus; BAFF, B-cell activating factor.

Availability of Data and Materials

All data generated or analysed during this study are included in this published article.

Author Contributions

JW designed the research study, performed the research. HL conducted experiments. QA analyzed the data. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study has been approved by the Ethics Committee of Shiyan Hospital of Integrated Traditional and Western Medicine, Ethical Approval Number: SY3287119. Informed consent was obtained from all study participants.

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Conflict of Interest

The authors declare no conflict of interest.

References

[1] Basta F, Fasola F, Triantafyllias K, Schwarting A. Systemic Lupus Erythematosus (SLE) Therapy: The Old and the New. Rheumatology and Therapy. 2020; 7: 433–446.

[2] Möckel T, Basta F, Weinmann-Menke J, Schwarting A. B cell activating factor (BAFF): Structure, functions, autoimmunity and clinical implications in Systemic Lupus Erythematosus (SLE). Autoimmunity Reviews. 2021; 20: 102736.

[3] Tanaka Y. State-of-the-art treatment of systemic lupus erythematosus. International Journal of Rheumatic Diseases. 2020; 23: 465–471.

[4] Durcan L, Petri M. Immunomodulators in SLE: Clinical evidence and immunologic actions. Journal of Autoimmunity. 2016; 74: 73–84.

[5] Blair HA, Duggan ST. Belimumab: A Review in Systemic Lupus Erythematosus. Drugs. 2018; 78: 355–366.

[6] Fanouriakis A, Kostopoulou M, Alunno A, Aringer M, Bajema I, Boletis JN, *et al*. 2019 update of the EULAR recommendations for the management of systemic lupus erythematosus. Annals of the Rheumatic Diseases. 2019; 78: 736–745.

[7] Durcan L, O'Dwyer T, Petri M. Management strategies and future directions for systemic lupus erythematosus in adults. Lancet. 2019; 393: 2332–2343.

[8] Teng YKO, Bruce IN, Diamond B, Furie RA, van Vollenhoven RF, Gordon D, *et al*. Phase III, multicentre, randomised, double-blind, placebo-controlled, 104-week study of subcutaneous belimumab administered in combination with rituximab in adults with systemic lupus erythematosus (SLE): BLISS-BELIEVE study protocol. BMJ Open. 2019; 9: e025687.

[9] Kiriakidou M, Ching CL. Systemic Lupus Erythematosus. Annals of Internal Medicine. 2020; 172: ITC81–ITC96.

[10] Tsokos GC. Systemic lupus erythematosus. The New England Journal of Medicine. 2011; 365: 2110–2121.

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[11] Ramsköld D, Parodis I, Lakshmikanth T, Sippl N, Khademi M, Chen Y, *et al*. B cell alterations during BAFF inhibition with belimumab in SLE. eBioMedicine. 2019; 40: 517–527.
[12] Navarra SV, Guzmán RM, Gallacher AE, Hall S, Levy RA, Jimenez RE, *et al*. Efficacy and safety of belimumab in patients with active systemic lupus erythematosus: a randomised, placebo-controlled, phase 3 trial. Lancet. 2011; 377: 721–731.
[13] Burness CB, McCormack PL. Belimumab: in systemic lupus erythematosus. Drugs. 2011; 71: 2435–2444.
[14] Oon S, Huq M, Golder V, Ong PX, Morand EF, Nikpour M. Lupus Low Disease Activity State (LLDAS) discriminates responders in the BLISS-52 and BLISS-76 phase III trials of belimumab in systemic lupus erythematosus. Annals of the Rheumatic Diseases. 2019; 78: 629–633.
[15] Furie R, Petri M, Zamani O, Cervera R, Wallace DJ, Tegzová D, *et al*. A phase III, randomized, placebo-controlled study of belimumab, a monoclonal antibody that inhibits B lymphocyte stimulator, in patients with systemic lupus erythematosus. Arthritis and Rheumatism. 2011; 63: 3918–3930.
[16] Stohl W, Schwarting A, Okada M, Scheinberg M, Doria A, Hammer AE, *et al*. Efficacy and Safety of Subcutaneous Belimumab in Systemic Lupus Erythematosus: A Fifty-Two-Week Randomized, Double-Blind, Placebo-Controlled Study. Arthritis & Rheumatology. 2017; 69: 1016–1027.
[17] Zhang F, Bae SC, Bass D, Chu M, Egginton S, Gordon D, *et al*. A pivotal phase III, randomised, placebo-controlled study of belimumab in patients with systemic lupus erythematosus located in China, Japan and South Korea. Annals of the Rheumatic Diseases. 2018; 77: 355–363.
[18] Kuhn A, Bonsmann G, Anders HJ, Herzer P, Tenbrock K, Schneider M. The Diagnosis and Treatment of Systemic Lupus Erythematosus. Deutsches Arzteblatt International. 2015; 112: 423–432.
[19] Jesus D, Matos A, Henriques C, Zen M, Larosa M, Iaccarino L, *et al*. Derivation and validation of the SLE Disease Activity Score (SLE-DAS): a new SLE continuous measure with high sensitivity for changes in disease activity. Annals of the Rheumatic Diseases. 2019; 78: 365–371.
[20] Brazier JE, Harper R, Jones NM, O'Cathain A, Thomas KJ, Usherwood T, *et al*. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. British Medical Journal. 1992; 305: 160–164.
[21] Wise LM, Stohl W. Belimumab and Rituximab in Systemic Lupus Erythematosus: A Tale of Two B Cell-Targeting Agents. Frontiers in Medicine. 2020; 7: 303.
[22] Perez RK, Gordon MG, Subramaniam M, Kim MC, Hartoularos GC, Targ S, *et al*. Single-cell RNA-seq reveals cell type-specific molecular and genetic associations to lupus. Science. 2022; 376: eabf1970.
[23] Bashant KR, Aponte AM, Randazzo D, Rezvan Sangsari P, Wood AJ, Bibby JA, *et al*. Proteomic, biomechanical and functional analyses define neutrophil heterogeneity in systemic lupus erythematosus. Annals of the Rheumatic Diseases. 2021; 80: 209–218.
[24] Tsokos GC. Autoimmunity and organ damage in systemic lupus erythematosus. Nature Immunology. 2020; 21: 605–614.
[25] Shipa M, Embleton-Thirsk A, Parvaz M, Santos LR, Muller P, Chowdhury K, *et al*. Effectiveness of Belimumab After Rituximab in Systemic Lupus Erythematosus: A Randomized Controlled Trial. Annals of Internal Medicine. 2021; 174: 1647–1657.
[26] Mohamed A, Chen Y, Wu H, Liao J, Cheng B, Lu Q. Therapeutic advances in the treatment of SLE. International Immunopharmacology. 2019; 72: 218–223.
[27] Bakshi J, Segura BT, Wincup C, Rahman A. Unmet Needs in the Pathogenesis and Treatment of Systemic Lupus Erythematosus. Clinical Reviews in Allergy & Immunology. 2018; 55: 352–367.
[28] Canny SP, Jackson SW. B Cells in Systemic Lupus Erythematosus: From Disease Mechanisms to Targeted Therapies. Rheumatic Diseases Clinics of North America. 2021; 47: 395–413.
[29] Samotij D, Reich A. Biologics in the Treatment of Lupus Erythematosus: A Critical Literature Review. BioMed Research International. 2019; 2019: 8142368.
[30] Narain S, Berman N, Furie R. Biologics in the treatment of Sjogren's syndrome, systemic lupus erythematosus, and lupus nephritis. Current Opinion in Rheumatology. 2020; 32: 609–616.
[31] Murphy G, Isenberg DA. New therapies for systemic lupus erythematosus - past imperfect, future tense. Nature Reviews. Rheumatology. 2019; 15: 403–412.
[32] Atisha-Fregoso Y, Toz B, Diamond B. Meant to B: B cells as a therapeutic target in systemic lupus erythematosus. The Journal of Clinical Investigation. 2021; 131: e149095.
[33] Lu Q, Long H, Chow S, Hidayat S, Danarti R, Listiawan Y, *et al*. Guideline for the diagnosis, treatment and long-term management of cutaneous lupus erythematosus. Journal of Autoimmunity. 2021; 123: 102707.
[34] Brunner HI, Abud-Mendoza C, Viola DO, Calvo Penades I, Levy D, Anton J, *et al*. Safety and efficacy of intravenous belimumab in children with systemic lupus erythematosus: results from a randomised, placebo-controlled trial. Annals of the Rheumatic Diseases. 2020; 79: 1340–1348.
[35] Fairley JL, Oon S, Saracino AM, Nikpour M. Management of cutaneous manifestations of lupus erythematosus: A systematic review. Seminars in Arthritis and Rheumatism. 2020; 50: 95–127.
[36] Jackson SW, Davidson A. BAFF inhibition in SLE-Is tolerance restored? Immunological Reviews. 2019; 292: 102–119.