J Inflamm Dis. 2026 March; 30(1): e172006 https://doi.org/10.69107/jid-172006

Published Online: 2026 March 31 **Review Article**

Systemic Lupus Erythematosus: Current Management Strategies and Emerging Therapeutic Advances - A Narrative Review

Nauman Ismat Butt [1,*], Hafiz Zaki Naeem [1], Muhammad Matee Ullah [1], Nubera Ahmed [1]

[1] Azra Naheed Medial College, Superior University, Lahore, Pakistan

[*] ***Corresponding Author:*** Department of Medicine and Allied, Azra Naheed Medial College, Superior University, Lahore, Pakistan. Email: nauman_ib@yahoo.com

Received: 17 February, 2026; **Revised:** 28 February, 2026; **Accepted:** 6 March, 2026

Abstract

Context: Systemic lupus erythematosus (SLE) is a chronic autoimmune disease characterized by multisystem involvement, autoantibody production, and immune complex-mediated tissue damage. It predominantly affects women of reproductive age and presents with a broad spectrum of clinical manifestations, ranging from cutaneous disease to severe organ involvement, including lupus nephritis and neuropsychiatric complications. Advances in understanding disease pathophysiology have highlighted the roles of B-cell hyperactivity, complement activation, and type I interferon signaling.

Evidence Acquisition: This narrative review synthesizes current evidence on the management of SLE, including conventional therapies, biologic agents, emerging treatments, and implementation challenges in resource-limited settings such as Pakistan.

Results: Conventional therapies, including hydroxychloroquine, corticosteroids, and immunosuppressants such as azathioprine, cyclophosphamide, and mycophenolate mofetil, remain the mainstay of treatment. However, long-term toxicity and incomplete disease control have driven the development of targeted biologic therapies. Biologic agents such as belimumab and anifrolumab represent important advances in precision medicine by targeting specific immune pathways and reducing disease activity and flares. Emerging strategies, including CAR-T cell therapy and hematopoietic stem cell transplantation, further expand the therapeutic landscape but remain experimental and are limited to specialized settings. Despite these therapeutic advances, challenges such as delayed diagnosis, limited access to biologics, and high treatment costs continue to affect outcomes in resource-limited regions.

Conclusions: Overall, SLE management is increasingly shifting toward personalized, targeted therapeutic approaches to improve long-term disease control and patient outcomes.

Keywords: Systemic Lupus Erythematosus, Rheumatology, Pakistan, Antinuclear Antibodies, Anti-double-stranded DNA Antibodies, Hydroxychloroquine, Belimumab, Anifrolumab

1. Context

Given its heterogeneous clinical presentation and unpredictable disease course, systemic lupus erythematosus (SLE) poses substantial challenges for early diagnosis, risk stratification, and long-term management. Over the past decade, advances in immunology have shifted therapeutic approaches from broad immunosuppression toward pathway-specific targeted therapies, particularly those directed at B-cell activity and type I interferon signaling (1). Despite these developments, variability in treatment response and persistent disease flares continue to contribute to cumulative organ damage and reduced quality of life (2). Furthermore, disparities in healthcare access and specialist availability remain major barriers to optimal disease control in many regions. These challenges underscore the need for an updated synthesis of current management strategies alongside emerging therapeutic options and real-world implementation barriers.

Although conventional therapies such as hydroxychloroquine, corticosteroids, and immunosuppressive agents remain the foundation of treatment, their long-term use is limited by toxicity and incomplete disease control in a substantial proportion of patients (1, 3). This has driven the development of

How to Cite: Butt NI, Naeem HZ, Ullah MM, Ahmed N. Systemic Lupus Erythematosus: Current Management Strategies and Emerging Therapeutic Advances - A Narrative Review. J Inflamm Dis. 2026;30(1):e172006. doi: https://doi.org/10.69107/jid-172006

biologic agents, including B-cell-targeted and interferon-pathway-directed therapies, representing a shift toward precision medicine in SLE management. In parallel, emerging approaches such as cellular therapies and stem cell transplantation are being explored for refractory disease, although their clinical applicability remains limited. However, the translation of these therapeutic advances into routine clinical practice is uneven, particularly in resource-limited settings, where diagnostic delays, restricted access to advanced therapies, and shortages of specialist care significantly affect outcomes (3, 4). This review therefore aims to provide a comprehensive overview of current and emerging SLE therapies while contextualizing their application in real-world healthcare environments.

The objective of this narrative review was to provide a comprehensive synthesis of current evidence on the management of SLE, including conventional therapies, biologic agents, and emerging treatment strategies. The review also highlights advances in targeted and precision medicine approaches and examines contextual challenges in implementing these therapies in resource-limited settings, particularly in Pakistan, where barriers to early diagnosis, access to biologics, and specialist care significantly influence disease outcomes.

2. Evidence Acquisition

This narrative review was conducted to summarize current evidence on the management of SLE, focusing on conventional therapies, biologic agents, and emerging treatment strategies. Relevant literature was identified through a non-systematic search of major biomedical databases, including PubMed, Google Scholar, and Scopus, and supplemented with guideline documents and key review articles. The search primarily covered publications from January 2015 to March 2026 to capture contemporary therapeutic advances, while landmark earlier studies were included as needed to provide foundational context.

Search terms included combinations of "systemic lupus erythematosus," "SLE management," "lupus nephritis," "hydroxychloroquine," "belimumab," "anifrolumab," "biologic therapy," and "emerging treatments." Studies were selected based on their clinical relevance to SLE management, emphasis on therapeutic interventions, and contribution to understanding disease pathophysiology or outcomes. Priority was given to recent peer-reviewed clinical trials, systematic reviews, meta-analyses, and international guideline statements. This review used a narrative synthesis approach. No formal risk-of-bias assessment or quantitative data synthesis was performed. Study selection and interpretation were guided by the authors' clinical judgment, with an emphasis on contemporary treatment paradigms and applicability to real-world clinical practice, including in resource-limited settings.

3. Results

3.1. Pathophysiology of Systemic Lupus Erythematosus

The pathophysiology of SLE is complex and involves multiple interacting immune mechanisms. A hallmark feature is the production of autoantibodies, such as anti-nuclear antibodies (ANA) and anti-double-stranded DNA (anti-dsDNA), which form immune complexes that deposit in tissues and trigger inflammation (5, 6). These immune complexes activate the complement system, leading to additional tissue injury and amplification of the inflammatory response. In addition, dysregulation of type I interferon pathways plays a central role in sustaining immune activation and promoting autoimmunity (6, 7). Genetic predisposition, environmental triggers (such as infections or ultraviolet light exposure), and hormonal factors collectively contribute to immune dysregulation (7, 8). The interplay between innate and adaptive immunity ultimately results in chronic inflammation and progressive organ damage if not adequately controlled.

3.2. Clinical Features of Systemic Lupus Erythematosus

The clinical manifestations of SLE are highly variable, reflecting its multisystem nature. Cutaneous involvement is common, with the classic malar rash appearing over the cheeks and nasal bridge and often exacerbated by sunlight exposure (9, 10). Musculoskeletal symptoms, particularly non-erosive arthritis, are also frequently observed and contribute substantially to morbidity. Renal involvement, known as lupus nephritis, is among the most serious complications and can progress to chronic kidney disease if untreated (10, 11). Neurological manifestations may include seizures, psychosis, cognitive dysfunction, and peripheral neuropathy, indicating involvement of the central or peripheral nervous system (1, 12). Hematological abnormalities are also common and may include anemia, leukopenia, lymphopenia, and thrombocytopenia due to immune-mediated destruction or bone marrow suppression (9, 12). The variability and unpredictability of these clinical features make early diagnosis and ongoing monitoring essential for disease management.

In addition, the severity and pattern of organ involvement often guide therapeutic decision-making, ranging from baseline immunomodulatory therapy to aggressive immunosuppression for organ-threatening disease. Early recognition of these manifestations is therefore critical to preventing irreversible organ damage and improving long-term outcomes. This clinical heterogeneity also supports the need for individualized, organ-specific treatment strategies in SLE.

3.3. Treatment of Systemic Lupus Erythematosus

Table 1 summarizes conventional, biologic, and emerging therapeutic approaches in SLE, highlighting mechanisms of action, clinical indications, and key limitations for each treatment class. This structured comparison clarifies the relative positioning of each therapeutic class within the overall treatment algorithm for SLE. It also facilitates a rapid clinical overview of evolving treatment strategies, ranging from conventional immunosuppression to targeted and investigational therapies.

3.4. Conventional Therapies

Conventional therapies remain the cornerstone of SLE management and primarily aim to control inflammation, prevent disease flares, and minimize long-term organ damage. Despite the emergence of targeted biologic agents, these treatments remain essential across all stages of disease severity because of their proven efficacy and broad clinical applicability.

3.4.1. Antimalarials

Hydroxychloroquine remains a cornerstone of SLE management and is recommended for nearly all patients unless contraindicated (6, 13). It exerts immunomodulatory effects by interfering with antigen presentation and toll-like receptor signaling, thereby reducing immune activation. Long-term hydroxychloroquine use has been shown to decrease disease flares, improve survival, and confer protective cardiovascular and metabolic benefits (14, 15). Its relatively favorable safety profile makes it suitable for chronic use, although regular ophthalmologic monitoring is necessary to prevent rare retinal toxicity (16).

3.4.2. Corticosteroids

Corticosteroids are widely used for the rapid control of acute disease exacerbations and severe organ involvement (17, 18). They suppress multiple inflammatory pathways and provide rapid symptomatic relief. However, prolonged use is associated with substantial adverse effects, including osteoporosis, hypertension, diabetes mellitus, weight gain, and increased infection risk (17, 18). Accordingly, current treatment strategies emphasize the use of the lowest effective dose for the shortest possible duration, often in combination with steroid-sparing agents to minimize long-term toxicity.

3.4.3. Immunosuppressants

Immunosuppressive agents such as azathioprine, methotrexate, cyclophosphamide, mycophenolate mofetil, and rituximab are commonly used in patients with moderate-to-severe disease or organ-threatening manifestations such as lupus nephritis (14). Azathioprine and methotrexate are often used for maintenance therapy because of their relatively safer long-term profiles, whereas cyclophosphamide is reserved for severe or refractory cases (13). Mycophenolate mofetil and rituximab have gained prominence because of their efficacy in inducing and maintaining remission in lupus nephritis, with more favorable safety profiles than older cytotoxic agents (6). These drugs play a critical role in controlling immune-mediated damage and preserving organ function.

3.5. Specific Biologic Therapies for Systemic Lupus Erythematosus

Biologic therapies are generally reserved for patients with moderate-to-severe or refractory SLE who have an inadequate response to conventional immunosuppressive regimens. They represent a targeted approach aimed at specific immune pathways, marking a transition from broad immunosuppression toward precision medicine in SLE management. However, the high cost and limited availability of biologic agents substantially restrict their use in resource-limited settings such as Pakistan, where access remains largely confined to select tertiary care centers.

3.5.1. Belimumab

Belimumab represents a significant advance in SLE management as the first approved biologic therapy specifically targeting the disease (19, 20). It inhibits B-lymphocyte stimulator (BLyS), a cytokine essential for B-cell survival and differentiation. By reducing the survival of autoreactive B cells, belimumab helps decrease autoantibody production and overall disease activity (19, 20). Clinical studies have demonstrated its effectiveness in reducing flares and steroid dependence,

Table 1. Overview of Therapies for Systemic Lupus Erythematosus: Mechanisms, Indications, and Limitations

Therapy Class	Example Agents	Mechanism of Action	Main Indications in SLE	Key Limitations
Antimalarials	Hydroxychloroquine	Inhibits toll-like receptor signaling and antigen presentation; immunomodulatory effects	All patients with SLE unless contraindicated	Retinal toxicity is rare; requires long-term monitoring
Corticosteroids	Prednisone, methylprednisolone	Broad anti-inflammatory and immunosuppressive effects	Acute flares and severe organ involvement	Long-term toxicity, including osteoporosis, diabetes, and infection risk
Conventional immunosuppressants	Mycophenolate mofetil, azathioprine, cyclophosphamide, methotrexate	Inhibit lymphocyte proliferation and immune activation	Moderate-to-severe SLE, lupus nephritis, and organ-threatening disease	Infection risk, cytopenias, and fertility concerns with cyclophosphamide
Biologic therapy (B-cell targeted)	Belimumab	Inhibits B-cell activating factor (BAFF/BLyS)	Active SLE with inadequate response to standard therapy	High cost and limited availability in low-resource settings
Biologic therapy (IFN pathway)	Anifrolumab	Blocks type I interferon receptor signaling	Moderate-to-severe SLE, especially skin and joint manifestations	Infection risk, cost, and limited long-term data
Investigational cellular therapy	CAR-T cell therapy	Depletion of autoreactive immune cells and immune reset	Refractory SLE in clinical trials or selected cases	Experimental status, safety concerns, and limited access
Experimental regenerative therapy	Hematopoietic stem cell transplantation	Immune system reset through hematopoietic reconstitution	Severe refractory SLE	High risk, transplant-related mortality, and limited availability

particularly in patients with active but non-severe disease (19, 20).

3.5.2. Anifrolumab

Anifrolumab is another important biologic agent that targets the type I interferon receptor, thereby blocking one of the central pathways implicated in SLE pathogenesis (21, 22). Type I interferons are known to drive immune activation and perpetuate chronic inflammation in patients with lupus. By inhibiting this signaling pathway, anifrolumab has shown promising results in reducing skin and joint manifestations, as well as overall disease activity (21, 22). Its introduction marks a shift toward precision immunotherapy in lupus treatment.

3.6. Advances in Lupus Nephritis

Lupus nephritis remains one of the most clinically significant organ-threatening manifestations of SLE and a major determinant of long-term morbidity and mortality (23). Contemporary management is typically structured into induction therapy, which aims to achieve rapid disease control, and maintenance therapy, which is designed to sustain remission and prevent relapse (6, 19). Induction therapy commonly includes high-dose corticosteroids combined with either mycophenolate mofetil or intravenous cyclophosphamide. Mycophenolate mofetil is frequently preferred because of its comparable efficacy and more favorable safety profile, whereas cyclophosphamide is generally reserved for severe or refractory disease (23, 24). Recent treatment strategies emphasize the early implementation of steroid-sparing approaches to minimize cumulative glucocorticoid toxicity.

Maintenance therapy is usually based on continued mycophenolate mofetil or azathioprine following successful induction. The goal is to maintain renal remission while reducing long-term immunosuppressive exposure (23, 24). In selected patients, particularly those with persistent disease activity or a high risk of relapse, biologic agents such as belimumab may be considered as adjunctive therapy to standard immunosuppression. Treatment outcomes are increasingly defined by the achievement of complete or partial renal remission, reduction in proteinuria, stabilization or improvement of glomerular filtration rate, and prevention of progression to end-stage renal disease (23, 25). Early response to therapy is a strong predictor of long-term renal survival.

Ongoing management also requires regular monitoring, including assessment of proteinuria, serum creatinine, estimated glomerular filtration rate, complement levels, and anti-dsDNA antibody titers (23, 25). Close clinical follow-up is essential to detect early relapse, guide tapering of immunosuppressive therapy, and minimize irreversible renal damage (14). Overall, advances in lupus nephritis management have improved renal outcomes by combining optimized immunosuppressive regimens with biologic adjuncts and treat-to-target strategies, although long-term prognosis remains dependent on early diagnosis and timely initiation of therapy.

3.7. Personalized and Precision Medicine in Systemic Lupus Erythematosus

Personalized and precision medicine is becoming increasingly important in SLE management (1, 26). Treatment decisions are increasingly guided by disease severity, specific organ involvement, and the presence of predictive biomarkers (26). Genetic profiling, autoantibody patterns, and interferon signature assessments are being explored to tailor therapy more precisely (1). This individualized approach allows clinicians to select therapies that are more effective for specific patient subgroups while minimizing unnecessary immunosuppression. The shift toward precision and personalized care reflects a broader trend in modern medicine aimed at improving efficacy and safety. However, implementation of precision medicine approaches is limited in low-resource settings because of restricted access to advanced biomarker testing and genetic profiling infrastructure.

3.8. Emerging Therapies for Systemic Lupus Erythematosus

Several emerging and highly specialized therapeutic approaches are under investigation for SLE, particularly for refractory or treatment-resistant disease. These strategies vary substantially in evidence maturity, clinical availability, and regulatory status. At present, these therapies should be regarded as experimental or investigational rather than established components of standard SLE management.

3.8.1. CAR-T Cell Therapy

CAR-T cell therapy represents an investigational approach in SLE and is currently limited to early-phase clinical studies and selected refractory cases (27, 28). It aims to deplete autoreactive B-cell populations and reset immune tolerance. Although early results are promising, its use remains experimental, with concerns regarding safety, long-term immune suppression, cost, and limited accessibility.

3.8.2. Hematopoietic Stem Cell Transplantation

Hematopoietic stem cell transplantation (HSCT) has been explored as a potential immune reset strategy in severe, refractory SLE (29, 30). However, it is not a standard therapy and is reserved for highly selected patients because of substantial risks, including treatment-related morbidity, infection, and transplant-related mortality. Its use remains restricted to specialized centers and clinical protocols.

3.8.3. Cytokine-Targeted and Next-Generation Biologic Therapies

Cytokine-targeted and next-generation biologic therapies include agents directed at interleukin pathways and interferon signaling and are at varying stages of development (31, 32). Some are in advanced clinical trials, whereas others remain preclinical or exploratory. These therapies aim to further refine immune modulation beyond currently approved biologics.

Overall, although these approaches represent important advances in immunology and translational medicine, they are not part of routine clinical practice in SLE management. Their role is currently limited to research settings or highly selected refractory cases, and further evidence is required before broader clinical adoption. Moreover, advanced interventions such as CAR-T cell therapy and stem cell transplantation remain inaccessible in most low- and middle-income countries because of infrastructural and financial constraints.

3.9. Healthcare Challenges in Pakistan

In Pakistan, SLE management is constrained by multiple healthcare system and socioeconomic barriers. Delayed diagnosis is common because of limited awareness among primary care providers and restricted access to rheumatology services, often resulting in patients presenting with established organ damage at their first specialist evaluation (33, 34). Limited availability of diagnostic immunological testing, including autoantibody profiling and complement levels, in peripheral healthcare facilities further contributes to diagnostic delay (34, 35). Access to biologic therapies such as belimumab and anifrolumab remains extremely limited because of high cost and lack of inclusion in most public-sector treatment programs. Consequently, these therapies are largely restricted to private tertiary care settings, creating substantial treatment inequity. Conventional immunosuppressive agents remain the mainstay of therapy, even for patients who may benefit from targeted biologics.

In addition, there is a shortage of trained rheumatologists relative to the national disease burden, leading to delayed referrals and suboptimal long-term disease monitoring (36). Irregular medication adherence due to financial constraints and inconsistent drug availability further contributes to poor disease control and higher flare rates. These systemic limitations substantially affect the real-world implementation of modern SLE management strategies, including biologic therapy, steroid-sparing approaches,

and emerging precision medicine models (4, 35). Consequently, patients in resource-limited settings such as Pakistan experience a delayed transition from conventional immunosuppression to targeted therapies, resulting in persistent disease activity and higher cumulative organ damage.

3.10. Future Perspectives and Recommendations

SLE management is expected to continue shifting toward increasingly precise, mechanism-based, and individualized therapeutic strategies. Advances in immunology, biomarker discovery, and molecular profiling are likely to further refine risk stratification and enable earlier identification of patients who may benefit from targeted therapies. Expansion of precision medicine approaches, including interferon signature-based stratification and genomic profiling, may improve treatment selection and optimize clinical outcomes. Emerging therapies, such as cellular-based interventions and novel biologic agents targeting specific immune pathways, represent promising developments; however, their clinical integration will depend on the generation of robust long-term efficacy and safety data, as well as improvements in affordability and accessibility. At present, these therapies remain largely restricted to clinical trials or specialized centers, underscoring the need for cautious, evidence-based adoption.

From a health systems perspective, strengthening early diagnostic capacity, particularly in primary care settings, is essential to reduce delays in treatment initiation and prevent irreversible organ damage. Increasing awareness of SLE among healthcare providers and improving access to immunological testing may substantially improve early detection rates. In resource-limited settings such as Pakistan, improving access to essential medications, expanding rheumatology training programs, and integrating cost-effective treatment protocols are critical steps toward improving outcomes. Inclusion of biologic therapies in broader healthcare coverage schemes and development of local treatment guidelines adapted to resource constraints may help bridge existing treatment gaps. Overall, future progress in SLE management will depend on a dual approach: continued advancement of targeted and innovative therapies alongside strengthening healthcare infrastructure to ensure equitable access to established and emerging treatments.

3.11. Limitations of the Review

This narrative review has several limitations. As a non-systematic literature review, study selection was not based on a structured protocol or formal risk-of-bias assessment, which may introduce selection bias. Although major biomedical databases and key publications were considered, the possibility of incomplete literature capture cannot be excluded. In addition, heterogeneity among available studies on SLE, particularly studies of emerging therapies, limits direct comparison and synthesis of findings. Evidence related to newer interventions such as cellular therapies remains preliminary and largely based on early-phase or experimental studies, which may limit generalizability to routine clinical practice. Furthermore, regional data from resource-limited settings, including Pakistan, remain scarce, which may affect the applicability of global evidence to local healthcare contexts.

4. Conclusions

Recent advances in the treatment of SLE have transformed disease management from generalized immunosuppression to more targeted and personalized therapeutic strategies. The introduction of biologic agents such as belimumab and anifrolumab has improved patient outcomes by targeting key immune pathways involved in disease pathogenesis, leading to fewer disease flares and improved quality of life. Beyond currently approved therapies, ongoing research is expanding the therapeutic pipeline to include precision medicine approaches and investigational cellular therapies. Among these, CAR-T cell therapy and hematopoietic stem cell transplantation represent highly specialized and experimental strategies that are currently limited to selected refractory cases or research settings. In contrast, established biologic agents remain the cornerstone of targeted SLE management in routine clinical practice.

Despite these therapeutic advances, translation into routine care remains uneven across healthcare systems. In resource-limited settings such as Pakistan, barriers including delayed diagnosis, restricted access to biologics, and shortages in the rheumatology workforce continue to limit the real-world impact of these innovations. These improvements are also reflected in lupus nephritis management, in which structured induction and maintenance regimens, along with earlier diagnosis and optimized immunosuppressive strategies, have contributed to improved rates of renal remission and reduced progression to end-stage renal disease.

Footnotes

AI Use Disclosure: For the purpose of Text Editing, the The Authors Acknowledge The Use Of Chatgpt (Openai) In Assisting With The Language Refinement And Editing Of This Manuscript. The Authors Reviewed The Changes, And Take Full Responsibility Of The Manuscript Content. was used Moderate in the Abstract section.

Authors' Contribution: Study concept and design: N. I. B., H. Z. N., M. M. U., and N. A; Acquisition of data: Not applicable; Analysis and interpretation of data: Not applicable; Drafting of the manuscript: N. I. B., H. Z. N., and N. A; Critical revision of the manuscript for important intellectual content: N. I. B. and M. M. U.; Statistical analysis: Not applicable; Administrative, technical, and material support: Not applicable; Study supervision: N. I. B.

Conflict of Interests Statement: The authors do not declare any conflicts of interests for this study.

Funding/Support: No funding support was received for this manuscript.

References

1. Saegusa K, Tsuchida Y, Komai T, Tsuchiya H, Fujio K. Advances in Targeted Therapy for Systemic Lupus Erythematosus: Current Treatments and Novel Approaches. *Int J Mol Sci*. 2025;**26**(3):929. [PubMed ID: 39940698]. [PubMed Central ID: PMC11816971]. https://doi.org/10.3390/ijms26030929.
2. Elia A, Zucchi D, Silvagni E, Oliva M, Cascarano G, Cardelli C, et al. Systemic lupus erythematosus: one year in review 2025. *Clin Exp Rheumatol*. 2025;**43**(3):397-406. [PubMed ID: 40072872]. https://doi.org/10.55563/clinexprheumatol/m0pi1k.
3. Pereira MG, Duarte S, Ferraz A, Santos M, Fontes L. Quality of life in patients with systemic lupus erythematosus: the mediator role of psychological morbidity and disease activity. *Psychol Health Med*. 2020;**25**(10):1247-1257. [PubMed ID: 32093519]. https://doi.org/10.1080/13548506.2020.1728350.
4. Malik T, Malik M, Ghani S, Butt NI, Jamil MS, Waris B. Health-related quality of life in systemic lupus erythematosus and its relationship with disease activity: a single-center cross-sectional study from Pakistan. *Cureus*. 2024;**16**(10). e72001. [PubMed ID: 39569218]. [PubMed Central ID: PMC11578622]. https://doi.org/10.7759/cureus.72001.
5. Barber MRW, Falasinnu T, Ramsey-Goldman R, Clarke AE. The global epidemiology of SLE: narrowing the knowledge gaps. *Rheumatology (Oxford)*. 2023;**62**(Suppl 1):i4-i9. [PubMed ID: 36987602]. [PubMed Central ID: PMC10050933]. https://doi.org/10.1093/rheumatology/keac610.
6. Ameer MA, Chaudhry H, Mushtaq J, Khan OS, Babar M, Hashim T, et al. An Overview of Systemic Lupus Erythematosus (SLE) Pathogenesis, Classification, and Management. *Cureus*. 2022;**14**(10). e30330. [PubMed ID: 36407159]. [PubMed Central ID: PMC9662848]. https://doi.org/10.7759/cureus.30330.
7. Rojas-Rivera JE, García-Carro C, Ávila AI, Espino M, Espinosa M, Fernández-Juárez G, et al. Diagnosis and treatment of lupus nephritis: a summary of the Consensus Document of the Spanish Group for the Study of Glomerular Diseases (GLOSEN). *Clin Kidney J*. 2023;**16**(9):1384-1402. [PubMed ID: 37664577]. [PubMed Central ID: PMC10468759]. https://doi.org/10.1093/ckj/sfad055.
8. Alforaih N, Whittall-Garcia L, Touma Z. A Review of Lupus Nephritis. *J Appl Lab Med*. 2022;**7**(6):1450-1467. [PubMed ID: 35932197]. https://doi.org/10.1093/jalm/jfac036.
9. Corbin D, Christian L, Rapp CM, Liu L, Rohan CA, Travers JB. New concepts on abnormal UV reactions in systemic lupus erythematosus and a screening tool for assessment of photosensitivity. *Skin Res Technol*. 2023;**29**(3). e13247. [PubMed ID: 36973991]. [PubMed Central ID: PMC10059080]. https://doi.org/10.1111/srt.13247.
10. Roveta A, Parodi EL, Brezzi B, Tunesi F, Zanetti V, Merlotti G, et al. Lupus Nephritis from Pathogenesis to New Therapies: An Update. *Int J Mol Sci*. 2024;**25**(16):8981. [PubMed ID: 39201667]. [PubMed Central ID: PMC11354900]. https://doi.org/10.3390/ijms25168981.
11. Ashfaq F, Butt NI, Rasheed MB, Ghoauri MSA, Anser A. Cerebritis as an initial presentation of systemic lupus erythematosus. *Anaesthesia Pain Intensive Care*. 2023;**27**(4):604-608. https://doi.org/10.35975/apic.v27i4.2214.
12. Yuce Inel T, Uslu S, Demirci Yildirim T, Gulle S, Sen G. Hematologic Involvement in Systemic Lupus Erythematosus: Clinical Features and Prognostic Implications in a Hematology-Referred Cohort. *J Clin Med*. 2025;**14**(20):7304. [PubMed ID: 41156173]. [PubMed Central ID: PMC12564963]. https://doi.org/10.3390/jcm14207304.
13. Ruiz-Irastorza G, Paredes-Ruiz D, Arizpe F, Campos-Rodriguez V, Moreno-Torres V, Amo L, et al. Hydroxychloroquine in patients with systemic lupus erythematosus: how much is enough? *Lupus Sci Med*. 2025;**12**(1). e001254. [PubMed ID: 40011066]. [PubMed Central ID: PMC11865800]. https://doi.org/10.1136/lupus-2024-001254.
14. Askanase AD, Furie RA, Dall'Era M, Bomback AS, Schwarting A, Zhao MH, et al. Disease-modifying therapies in systemic lupus erythematosus for extrarenal manifestations. *Lupus Sci Med*. 2024;**11**(1). e001124. [PubMed ID: 38777595]. [PubMed Central ID: PMC11116871]. https://doi.org/10.1136/lupus-2023-001124.
15. Dima A, Jurcut C, Chasset F, Felten R, Arnaud L. Hydroxychloroquine in systemic lupus erythematosus: overview of current knowledge. *Ther Adv Musculoskelet Dis*. 2022;**14**:1759720X211073001. [PubMed ID: 35186126]. [PubMed Central ID: PMC8848057]. https://doi.org/10.1177/1759720X211073001.
16. Donica AL, Donica VC, Russu M, Lăpuşte V, Pomîrleanu C, Bogdănici CM, et al. Optical Coherence Tomography and Angiography in Hydroxychloroquine Retinopathy: A Narrative Review. *Diagnostics (Basel)*. 2026;**16**(3):463. [PubMed ID: 41681781]. [PubMed Central ID: PMC12896917]. https://doi.org/10.3390/diagnostics16030463.
17. Enríquez-Merayo E, Cuadrado MJ. Steroids in Lupus: Enemies or Allies. *J Clin Med*. 2023;**12**(11):3639. [PubMed ID: 37297834]. [PubMed Central ID: PMC10253271]. https://doi.org/10.3390/jcm12113639.
18. Martin-Iglesias D, Paredes-Ruiz D, Ruiz-Irastorza G. Use of Glucocorticoids in SLE: A Clinical Approach. *Mediterr J Rheumatol*. 2024;**35**(Suppl 2):342-353. [PubMed ID: 39193186]. [PubMed Central ID: PMC11345604]. https://doi.org/10.31138/mjr.230124.uos.
19. Singh JA, Shah NP, Mudano AS. Belimumab for systemic lupus erythematosus. *Cochrane Database Syst Rev*. 2021;**2**(2):CD010668. [PubMed ID: 33631841]. [PubMed Central ID: PMC8095005]. https://doi.org/10.1002/14651858.CD010668.pub2.
20. Kojima K, Ichinose K, Umeda M, Shimizu T, Sato S, Suzuki T, et al. Enhancing systemic lupus erythematosus treatment outcomes with an early initiation of belimumab: insights from a multicenter retrospective study within the first five years. *Arthritis Res Ther*. 2025;**27**(1). 116. [PubMed ID: 40442811]. [PubMed Central ID: PMC12121007]. https://doi.org/10.1186/s13075-025-03581-0.
21. Calvo-Río V, Secada-Gómez C, Martín-Gutiérrez A, Retuerto-Guerrero M, Font J, Casafont-Solé I, et al. Anifrolumab in systemic lupus

erythematosus: real-world evidence from a Spanish multicentre cohort of 206 patients and literature review. *RMD Open*. 2026;**12**(1). e006549. [PubMed ID: 41856562]. [PubMed Central ID: PMC13007143]. https://doi.org/10.1136/rmdopen-2025-006549.

22. Borowy P, Kamińska A, Major P, Smyk J, Gołojuch K, Batko B. Anifrolumab in the treatment of recurrent systemic lupus erythematosus: the first post-trial case report. *Cent Eur J Immunol*. 2025;**50**(1):105-108. [PubMed ID: 40620654]. [PubMed Central ID: PMC12224262]. https://doi.org/10.5114/ceji.2025.148001.
23. Avasare R, Drexler Y, Caster DJ, Mitrofanova A, Jefferson JA. Management of Lupus Nephritis: New Treatments and Updated Guidelines. *Kidney360*. 2023;**4**(10):1503-1511. [PubMed ID: 37528520]. [PubMed Central ID: PMC10617804]. https://doi.org/10.34067/KID.0000000000000230.
24. Teoh STY, Yap DYH, Chan TM. Ten tips in lupus nephritis management. *Clin Kidney J*. 2024;**18**(1). sfae376. [PubMed ID: 39872638]. [PubMed Central ID: PMC11770280]. https://doi.org/10.1093/ckj/sfae376.
25. Wiegley N, Arora S, Norouzi S, Rovin B. A Comprehensive and Practical Approach to the Management of Lupus Nephritis in the Current Era. *Adv Kidney Dis Health*. 2024;**31**(3):234-245. [PubMed ID: 39004463]. https://doi.org/10.1053/j.akdh.2023.11.003.
26. Brant EJ, Rietman EA, Klement GL, Cavaglia M, Tuszynski JA. Personalized therapy design for systemic lupus erythematosus based on the analysis of protein-protein interaction networks. *PLoS One*. 2020;**15**(3). e0226883. [PubMed ID: 32191711]. [PubMed Central ID: PMC7081981]. https://doi.org/10.1371/journal.pone.0226883.
27. Zhou J, Lei B, Shi F, Luo X, Wu K, Xu Y, et al. CAR T-cell therapy for systemic lupus erythematosus: current status and future perspectives. *Front Immunol*. 2024;**15**. 1476859. [PubMed ID: 39749335]. [PubMed Central ID: PMC11694027]. https://doi.org/10.3389/fimmu.2024.1476859.
28. Guffroy A, Jacquel L, Guffroy B, Martin T. CAR-T cells for treating systemic lupus erythematosus: A promising emerging therapy. *Joint Bone Spine*. 2024;**91**(5). 105702. [PubMed ID: 38336271]. https://doi.org/10.1016/j.jbspin.2024.105702.
29. Dao LTM, Vu TT, Nguyen QT, Hoang VT, Nguyen TL. Current cell therapies for systemic lupus erythematosus. *Stem Cells Transl Med*. 2024;**13**(9):859-872. [PubMed ID: 38920310]. [PubMed Central ID: PMC11386214]. https://doi.org/10.1093/stcltm/szae044.
30. Zare Moghaddam M, Mousavi MJ, Ghotloo S. Stem cell-based therapy for systemic lupus erythematous. *J Transl Autoimmun*. 2024;**8**. 100241. [PubMed ID: 38737817]. [PubMed Central ID: PMC11087996]. https://doi.org/10.1016/j.jtauto.2024.100241.
31. Chen Z, Liu S, Xie R, Zhang P, Feng Y. Cytokine networks and therapeutic advances in systemic lupus erythematosus. *Front Immunol*. 2025;**16**. 1680418. [PubMed ID: 41280899]. [PubMed Central ID: PMC12634530]. https://doi.org/10.3389/fimmu.2025.1680418.
32. Zarei-Behjani Z, Hosseinpouri A, Fotoohi M, Shafiee A, Asadi D. Beyond conventional treatment: Novel cell therapies for systemic lupus erythematosus. *J Transl Autoimmun*. 2025;**11**. 100308. [PubMed ID: 40978494]. [PubMed Central ID: PMC12444481]. https://doi.org/10.1016/j.jtauto.2025.100308.
33. Butt NI, Waris B, Khizar I. The Silent Struggle: Raising Awareness About Systemic Lupus Erythematosus in Pakistan. *J Health Rep Technol*. 2025;**11**(4). e166662. https://doi.org/10.5812/jhrt-166662.
34. Khan R, Imami SK, Anwer Khan SE, Batool S, Naeem F, Zaffar MA. It's About Time: A Study of Rheumatology Patient Consultation Times. *Cureus*. 2023;**15**(10). e48007. [PubMed ID: 38034181]. [PubMed Central ID: PMC10687325]. https://doi.org/10.7759/cureus.48007.
35. Sharif M, Sufyan Khan M, Khursheed Ahmed T, Shah S, Tahir S, Punshi A. Socioeconomic burden of major rheumatic diseases in a tertiary care facility. *Pak BioMed J*. 2022;**5**(6):200-203. https://doi.org/10.54393/pbmj.v5i6.575.
36. Khan A, Salim B, Perveen S, Samreen S, Gul H, Nasim A. Overcoming rheumatoid arthritis challenges: Ensuring timely referral to rheumatologists in resource-scarce countries. *Rheumatol Immunol Res*. 2023;**4**(4):222-224. [PubMed ID: 38125644]. [PubMed Central ID: PMC10729589]. https://doi.org/10.2478/rir-2023-0033.