Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/22587
DOI URL: http://dx.doi.org/10.21474/IJAR01/22587

RESEARCH ARTICLE

LATEST UPDATES IN MANAGEMENT OF MULTIPLE SCLEROSIS DISEASE

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Manuscript Info

Manuscript History
Received: 04 October 2025
Final Accepted: 06 November 2025
Published: December 2025

Key words:-
Multiple Sclerosis, Diagnosis of MS, Treatment of MS, Management

Abstract

The rising prevalence of Multiple Sclerosis in Saudi Arabia has significant ramifications for healthcare planning and resource distribution as well. High-efficacy therapy is effective, but it can be expensive, and its optimal application necessitates significant patient safety and monitoring facilities. The need for long-term follow-up, managing therapy-related risks, and providing supportive care also places a significant strain on neurology services. In lieu of the same this present study evaluates the latest updates related to diagnosis, treatment and prevention from Multiple Sclerosis. This is a systematic review study based on the realted studies conducted in the recent past.

Introduction:-

Multiple sclerosis (MS) is a progressive, immune-mediated illness of the central nervous system (CNS), involving inflammation, demyelination, and neurodegeneration. **[3]** MS is one of the leading causes of non-traumatic

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neurological impairment in young people, primarily affecting women and typically manifesting between the ages of 20 and 40. Multiple sclerosis (MS), which has historically been thought to be uncommon in the Middle East, has significantly increased in incidence and prevalence in the Gulf region and the Kingdom of Saudi Arabia (KSA), according to new epidemiological research. **[1]** Changes in lifestyle, maybe environmental and genetic predisposing factors, and an increase in diagnostic capabilities and disease knowledge are thought to be the causes of these changes. **[5], [6]**The latest multicenter registry data in Saudi Arabia indicate that the overall frequency is roughly 40.4 per 100,000 population, with the prevalence among Saudi nationals reaching over 61.9 per 100,000. **[2], [7]** This is significantly more than previous findings from the 1980s and 1990s, when MS was thought to be uncommon in the area. Increased participation in clinical research, improved access to MRI technology, and improved diagnostic standards are some of the possible causes of this rise. However, regional research has shown that there are differences in awareness, delays in diagnosis, and unequal access to specialized MS care, especially in underserved and rural areas. **[11]**

Over the past 20 years, there has been a notable acceleration in MS therapy worldwide. From the initial generation of injectable interferon-beta and glatiramer acetate therapy to a wide range of highly effective disease-modifying therapies (DMTs), the horizon has broadened to encompass immune reconstitution techniques like autologous hematopoietic stem cell transplantation (aHSCT), **[13]** monoclonal antibodies, and oral sphingosine-1-phosphate receptor modulators. Brain-penetrant Bruton's tyrosine kinase (BTK) inhibitors, **[14]** which target B-cell signaling and microglial activation, processes of increasing importance in the course of the disease, have been considered potential medicines in progressive and relapsing multiple sclerosis in recent years. **[17]**Alongside pharmacological advancements, the significance of comprehensive, multidisciplinary management, which addresses not just disease activity but also symptom control, rehabilitation, mental health, and quality of life has come to light more and more. Depression, fatigue, stiffness, bladder problems, and cognitive impairment are common in multiple sclerosis and can significantly impact daily functioning. **[7], [8]** Customized patient education, culturally relevant counseling, and family engagement are crucial components of effective care in Saudi Arabia, where social and cultural contexts influence health-seeking behavior.

Improvements to the McDonald criteria have made it possible to diagnose multiple sclerosis (MS) earlier and more accurately, even in patients who have clinically isolated syndrome (CIS) and radiologically isolated syndrome (RIS). **[12], [13]** The use of fluid biomarkers like neurofilament light chain (NfL) and advanced imaging techniques, such as the detection of cortical lesions, paramagnetic rim lesions, and central vein signals, are opening up new avenues for disease tracking and prognosis. By applying these improvements to the Saudi healthcare system, treatment start may be maximized and diagnostic delays could be reduced. **[19]**The rising prevalence of MS in Saudi Arabia has significant ramifications for healthcare planning and resource distribution as well. High-efficacy therapy is effective, but it can be expensive, and its optimal application necessitates significant patient safety and monitoring facilities. **[17], [14]** The need for long-term follow-up, managing therapy-related risks, and providing supportive care also places a significant strain on neurology services. A nation with a large geographical area and urbanized centers has a great deal of potential to make effective use of telemedicine services. Telemedicine, which was expanded during the COVID-19 pandemic, offers a method to solve geographic disparities of access to MS specialists. **[21]**

Genetic and Environmental Risk Factors in the Saudi Context:-

The etiology of MS is complex, involving the interaction of environmental exposure and genetic predisposition. Several genetic and epidemiologic investigations have identified potential risk factors in the Saudi setting. Saudi communities have been found to carry the recognized European genetic risk allele for multiple sclerosis, HLA-DRB1*15:01, **[15]** though at variable rates and perhaps in combination with other regional haplotypes. **[24]** A more significant heritable component than previously thought has been shown by local investigations that have shown familial aggregation of MS cases. MS prevalence may have increased in the Kingdom due to a combination of genetic predisposition and the significant changes in lifestyle that have occurred in recent decades. **[15], [13]**

Reduced vitamin D levels, likely as a result of clothing choices that limit sun exposure and prevent going outside during hot weather, dietary practices that involve consuming less omega-3 fatty acids and more saturated fat, and high obesity rates, especially among women, are environmental risk factors of particular interest to the Saudi populace. **[12], [6]** In certain groups, tobacco use, a known risk factor for MS, is also highly prevalent. Lower amounts of physical activity and an urban lifestyle may also affect MS risk and the immune system. The interaction between predisposing genetics and certain environmental exposures emphasizes the significance of targeted preventative initiatives, including vitamin supplementation programs, lifestyle modification campaigns, and public health education campaigns.

Given these developments, there is a pressing need to synthesize the latest global and regional evidence on MS management in a way that is directly relevant to Saudi clinical practice. This review aims to provide an updated, comprehensive overview of recent advances in the management of MS — including pharmacological, diagnostic, and supportive strategies — with a specific focus on their applicability in the Saudi context. By integrating international best practices with local epidemiological data, healthcare infrastructure realities, and cultural considerations, the goal is to support clinicians, policymakers, and researchers in optimizing care pathways for people living with MS in the Kingdom.

Objective of the Study:-

The study's goals are to provide an overview of new disease-modifying therapies (DMTs), updated clinical criteria, and emerging diagnostic tools. These include drugs that target progressive forms of multiple sclerosis (MS) and the assessment of supportive and multidisciplinary care approaches that enhance quality of life, long-term functional outcomes, and symptom control.

Research Methodology:-

Research Design:-

Using a systematic search and selection process, this work is constructed as a narrative review that incorporates Saudi and international literature on MS management. The methodology follows an open and repeatable manner to give comprehensive coverage of linked advancements in diagnosis, therapy, and healthcare delivery, even though it is not a comprehensive systematic review.

Sources of Data and Structure:-

A detailed literature review was done to know about the latest evidences available in terms of managing MS. The focus of these literature search was mainly on the studies published or presented in the time period of 2018 to 2025

The researcher has touched the following sources:

- PubMed/MEDLINE
- EMBASE
- Cochrane Library
- Scopus
- Web of Science
- ClinicalTrials.gov (for ongoing and recently completed trials)

Then on the other hand the researhcer has also followed the national and intenational guidelines to become double sure about the sources of data and management of MS in the current scenarrio, some of such guidelines are as follows:

a. American Academy of Neurology (AAN),
b. European Academy of Neurology (EAN),
c. European Committee for Treatment and Research in Multiple Sclerosis (ECTRIMS), and
d. Saudi Neurology Society

Important Keywords:-

“Multiple sclerosis”, “MS”, “management”, “treatment”, “therapy”, “disease-modifying”, “BTK inhibitor”, “stem cell transplantation”, “CAR-T”, “rehabilitation”, “guidelines”, “Saudi Arabia”, “Gulf Cooperation Council”, “Middle East”.

Data Collection:-

Researcher have reached many of the sources of the collecting relevant studies, some of the avenues were electronic as well, like Saudi Digital Library, PubMed/MEDLINE, Scopus, Web of Science, Embase, and even Google Scholar. To collect both recent and older data relevant to the patterns under consideration, the search was restricted to the time period of 2014 to 2024.

Inclusion and exclusion Criteria:-

Inclusion:-

- Types of studies: Randomized controlled trials (RCTs), phase II/III clinical trials, observational studies, systematic reviews, meta-analyses, and clinical guidelines.
- Population: Adults or pediatric patients diagnosed with MS according to defined diagnostic criteria (McDonald criteria).
- Intervention: Any symptomatic management approach, disease-modifying therapy (DMT), rehabilitative intervention, or model of healthcare delivery.
- Dates of publication: From January 2018 to March 2025 for worldwide literature; no date limit for Saudi epidemiologic or registry data.
- Language: English.

Exclusion:-

Small case series or case reports with less than ten patients are not included unless they are an innovation that changes practice. Animal-only studies, preclinical research without human data, and non-English articles without translations are not included. Editorials or opinion pieces without a synthesis of the supporting data are also not included.

Process of Data Preparation:-

The collected data was extracted and prepared on the basis of following component:

- ✧ Author(s), year, country of origin
- ✧ Study design and population characteristics
- ✧ Diagnostic criteria and tools used
- ✧ Type of intervention or management strategy
- ✧ Key outcomes (relapse rate, MRI activity, confirmed disability progression, safety profile, quality-of-life measures)
- ✧ Applicability and relevance to the Saudi context (e.g., local availability, regulatory approval, cost considerations)

Discussion:-

Saudi Context of Multiple Sclerosis:-

An MS prevalence of around 40.4% per 100,000 people was found in a nationwide multicenter registry, with a greater prevalence among Saudi citizens (approximately 61.95 per 100,000). **[22], [24]** According to these prevalence estimates, MS is a major neurological burden in the Kingdom. Patients' interest in getting disease information and genetic and diagnostic counseling is reported in recent cross-sectional surveys conducted in Saudi Arabia, which also reveal unequal population awareness. The necessity of systematic patient education and shared decision-making is underscored by these findings. **[7]** Services must organize national registries to monitor long-term outcomes, take into account geographical differences (urban and rural centers), and provide clinical training in compliance with new standards. **[9]**

Updates on Diagnosis:-

The 2024 updates have placed a greater emphasis on MRI standards and biomarkers with the goal of reducing diagnostic delay and improving radiologically isolated syndrome and early disease characterization. **[16], [9], [10]** These McDonald's diagnostic criteria have been further improved in terms of specificity and sensitivity. Early diagnosis is still essential for enabling prompt DMT initiation. Biomarkers: More focus is being placed on neurofilament light chain (NfL) in serum as a gauge of disease activity and treatment response, as well as on sophisticated MRI metrics to measure smoldering lesions and paramagnetic rim lesions that may be indicative of evolution. We advise Saudi tertiary institutions to standardize their MRI procedures and, if possible, incorporate serum NfL to help determine the appropriate level of treatment. **[26]**

Disease Modification Therapies (DMT):-

Early high-efficacy therapy in highly active disease against plans of escalation are two examples of the individualized safety and efficacy balance required for modern management. Guidelines provide advice on initiation, switching, follow-up, and pregnancy issues (ABN updates, AAN). **[14]**Ofatumumab and ocrelizumab, two Anti-CD20 medicines, remain the mainstays of treatment for both active primary progressive MS and relapse MS.They are proven to suppress the formation of MRI lesions and lower recurrence; nevertheless, vaccination

delivery and infection risk must be carefully managed. **[1], [12]**BTK inhibitors are brain-penetrating medications that target microglial and B-cell signaling. In a clinical trial for non-relapsing secondary progressive multiple sclerosis, tolebrutinib showed promise in reducing disability accrual. The drug has been submitted for regulatory approval (FDA dates and Breakthrough designation stated). Previous research on relapsing-MS were not conclusive, and liver safety monitoring is often used. An important treatment advancement in progressive MS phenotypes is represented by the NEJM publication of tolebrutinib data and regulatory submission in 2024–2025. **[22], [29], [18]** Implications for Saudi practice: BTK inhibitors may fill a gap in the treatment of progressive multiple sclerosis if and when they are licensed and made available domestically. **[11]** However, authorities and doctors must create patient selection criteria and adhere to safety data, particularly those pertaining to hepatic consequences. Oral medicines continue to play a role for many patients, but they must be administered with cardiac and infection precautions when appropriate. Siponimod and other medications have specific indications for active secondary progressive multiple sclerosis. **[21], [16]**

Autologous hematopoietic stem cell transplantation (aHSCT):-
In carefully chosen individuals with extremely active relapsing disease, aHSCT may be more effective than some of the highest-efficacy DMTs if administered early in the course of the disease, according to several comparative and systematic evaluations that show it offers long-lasting reduction of inflammatory activity. **[3], [28]** Multidisciplinary evaluation of procedure-related complications and cognitive results is required. Standardized eligibility criteria (e.g., early aggressive illness onset, extremely active disease despite high-efficacy DMTs) and nationwide referral networks should be developed because aHSCT requires well resourced centers with transplantation competence and infection control. **[18], [21]**

Emerging immune and cell therapies (CAR-T and others):-
CAR-T strategies for autoreactive lymphocytes are among the targeted cellular therapy trials described in early translational work and conference reports (ECTRIMS 2024). These should only be used in clinical studies because they are experimental.

Management and multidisciplinary care:-
Symptom management (spasticity, neuropathic pain, fatigue, bladder dysfunction) continues to be key to quality of life. There is evidence in favor of pharmacotherapy (e.g., SNRs, antispaistics), focused intrathecal therapy, and nonpharmacological interventions (physiotherapy, CBT for fatigue) Mental health screening and interventions (depression/anxiety) are essential, Saudi studies emphasize high prevalence of mood disorders in pwMS and the need for integrated services. **[23], [27]** These are recommended to be established as multidisciplinary MS clinics in tertiary Saudi centres such as neurology, neurorehabilitation, urology, psychiatry, and specialist nurses. **[19]**

Pregnancy and Pediatric MS:-
Many DMTs have pregnancy-specific safety profiles; planning, washout intervals, and family planning counselling are critical. Recent guidelines provide specific recommendations for stopping/continuing DMTs around conception and breastfeeding. **[26], [10]** Pediatric MS requires tailored approaches (weight-based dosing, neurodevelopmental support) and often more aggressive inflammatory activity; early specialist referral is essential.

Conclusion:-

For these advances to be implemented in Saudi Arabia, they must be in line with the country's epidemiology, medical facilities, and governmental priorities. The expansion of specialists' coverage to secondary cities, community awareness, access to effective therapy, and the improvement of national registries are all important steps in the process of optimizing results. In the coming years, Saudi clinicians and policymakers may improve MS care by integrating global best practices with local strategies to make it more consistent, evidence-based, and patient-centered. A thorough awareness of the various symptoms of multiple sclerosis is necessary for the proper diagnosis and treatment of these symptoms, as this review emphasizes. It is recommended that MS patients be vaccinated if the conditions listed in this review are not met.

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