NURSING PRACTICE IN MULTIPLE SCLEROSIS

A CORE CURRICULUM

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Nursing Practice in Multiple Sclerosis
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Ms. Halper has published and lectured extensively on multiple sclerosis and its ramifications. Her numerous publications include *Comprehensive Nursing Care in Multiple Sclerosis* and *Advanced Concepts in Nursing Care in Multiple Sclerosis*, and she was a coeditor of *Staying Well With Multiple Sclerosis: A Self-Care Guide* and *Nursing Practices in Multiple Sclerosis: A Core Curriculum*. She is a member of the American Academy of Nurse Practitioners, the founding director of the International Organization of MS Nurses (IOMSN), and the recipient of the IOMSN’s first June Halper Award for Excellence in Nursing in Multiple Sclerosis. Ms. Halper continues to be involved in clinical care as a nurse practitioner at the MS Center of the New Jersey Medical School, Rutgers University, Newark, New Jersey, and at the Bergen Volunteer Medical Initiative in Hackensack, New Jersey. She is dedicated to the fight against MS through educating the next generation of health care professionals, as well as expanding research to promote best practices in the comprehensive management of the disease.

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Her interests specific to MS include intrathecal baclofen therapy, pain management, health outcomes research, and the development of multidisciplinary collaborative models of care.

Ms. Harris, along with several of her MS nursing colleagues from North America, Europe, and Australia, was involved in the creation of the International Organization of MS Nurses (IOMSN) and is one of the past presidents of the organization. She has been active in committee and project work with the Consortium of Multiple Sclerosis Centers (CMSC) for 25 years and was president of the organization from 2007 to 2009. She is the chair of the education committee of IOMSN, and under her leadership, the IOMSN has developed and conducted a wide variety of live, web-based, and enduring educational programs for nursing professionals.
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Multiple sclerosis (MS) nursing requires new and innovative strategies and structure to meet the complex needs of MS nursing professionals, who range from licensed practical nurses (LPNs) and RNs to advanced practice nurses (nurse practitioners and clinical nurse specialists). The content of this book focuses on the knowledge that MS nursing professionals need to support their professional growth and development. This nursing specialty has evolved from an underrecognized cadre of historic figures in multiple sclerosis to a broad spectrum of nursing professionals who practice throughout the world.

Linda Morgante set the stage for us by investigating the concept of hope in MS, a disease with enormous implications for patients and families as well as the health care community. We have adopted the model of care shown in the preceding figure into this work, as well as all of our other publications. This model incorporates the domains of MS nursing—clinical care, education, research, and advocacy—into an algorithm that has the leitmotif of hope throughout all nursing activities.

*June Halper and Colleen Harris*
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OBJECTIVES

Upon completion of this chapter, the learner will be able to:

■ List the four domains of multiple sclerosis (MS) nursing
■ Describe nursing activities related to the core of care
■ Cite professional responsibilities required to sustain the MS nursing role

Nursing domains are considered the full range of nursing practice that may be called into use to serve the patient with multiple sclerosis (MS) and his or her family.

■ MS practice domains are broad areas of accountability.

■ Broad areas of practice include the full range of knowledge, skills, and tasks of MS nursing responsibility.

A. It is important to recognize the unique nature of MS and its chronic and dynamic nature.

B. Planning and implementing care requires flexibility, cultural sensitivity, and an ability to relate closely to the patient and family.
The domains of MS nursing include the following:

A. Clinical practice
B. Advocacy
C. Education
D. Research

The universal tasks of MS nursing are as follows:

A. Establishment of a therapeutic partnership
B. Performance of a comprehensive assessment
C. Formulation of a collaborative treatment plan
D. Initiation, facilitation, and maintenance of a treatment regimen
E. Evaluation of a treatment plan

Domain: Clinical practice—knowledge

A. Pathophysiology of disease
   1. Immune dysfunction
   2. Nerve conduction
B. Definition, course, and classification
C. Epidemiology and distribution
D. Symptomatology
E. Diagnosis of MS
   1. Presenting symptoms
   2. Prognostic indicators
   3. Diagnostic tests

Domain: Clinical practice—knowledge and skills

A. Relapse management
B. Disease-modifying agents
C. Symptoms and symptom management
D. Psychosocial issues

Domain: Advocacy

A. Advocacy tasks
   1. Negotiate for the patient and family in the health care system
   2. Advocate self-care strategies
   3. Serve as a consultant
4. Increase awareness of MS in the community  
5. Protect patient rights  
6. Examine practice outcomes  

B. Advocacy requires knowledge and skills  
1. Patient rights  
2. Ethical practice  
3. Negotiating the health care system  
4. Empowerment  
5. Public speaking  
6. Local and national health policy  
7. Disease expertise

■ Domain: Education  
A. Patient education  
1. Knowledge of MS  
2. Nursing process and theory  
3. Principles of teaching and learning  
B. Professional development  
1. Role model  
2. Mentor  
3. Preceptor  
4. Public speaker  
5. Support group leader  
6. Writer  
7. Membership in professional organizations

■ Domain: Research  
A. Knowledge of research terminology and process  
B. Protection of human subjects  
C. Evidence-based practice  
D. Research tasks and skills  
1. Proper sample collection  
2. Preparation and documentation  
3. Communication skills  
4. Research design, ethical principles  
5. Drive to increase nursing body of knowledge
MS NURSING PERFORMANCE ACTIVITIES

Assessment

- The MS nurse collects and assesses patient health data.

MEASUREMENT CRITERIA

- Data collection involves the patient, family, and other health care providers as appropriate.
- The priority of data collection activities is determined by the patient’s immediate condition or needs.
- Patient data are collected and assessed using appropriate assessment techniques and instruments such as physical assessment, documentation review, and interviews as appropriate to licensure and level of practice.
- Relevant data are documented in a retrievable form.
- The data collection process is systematic and ongoing. It is based on a working knowledge of the effects of MS and the manifestation of those effects.

Nursing Diagnosis

- The MS nurse analyzes patient health data and determines nursing diagnoses.

MEASUREMENT CRITERIA

- Diagnoses are derived from the assessment data. Diagnoses address all issues that are pertinent to the patient’s health and success in the family, the workplace, and the community. Diagnoses may include the identification of actual or potential responses or illness with pertinent etiologies or risk factors, with regard to the following:
  A. Alterations in physical status, including complex assessment of organ systems, bowel and bladder functional assessment, respiratory deficits, and muscle and sensory loss or alteration
  B. Status of self-care activities, rehabilitation potential, functional level ability, and potential functional ability
  C. Emotional stress or crisis components of disability, pain, self-concept, and individual and family development states
  D. Alterations in thinking, perception, communication, and decision making
  E. Adaptation to and coping with alterations due to disability, durable medical equipment, home, and lifestyle changes
F. Educational assessment of patient, family, and other care providers

G. Age-related and cultural issues

- Diagnoses are validated with the patient, family, significant other, and other health care providers, when possible and appropriate.
- Diagnoses are documented in a manner that facilitates the determination of optimal health care, expected outcomes, and plan of care.

**Outcome Identification**

- The MS nurse identifies expected outcomes individualized to the patient.

**MEASUREMENT CRITERIA**

- Outcomes are derived from the diagnoses. Expected outcomes are based on scientific knowledge about the outcomes of MS.
- Outcomes are mutually formulated with the patient, family, and other health care providers when possible and appropriate.
- Outcomes focus on maintaining an optimal level of functioning and independence, promoting health and quality of life, and preventing complications throughout the life span.
- Outcomes are culturally appropriate and realistic in relation to the patient’s present and potential capabilities.
- Outcomes are attainable in relation to resources available to the patient.
- Outcomes include a time estimate for attainment.
- Outcomes provide direction for continuity of care.
- Outcomes are documented as measurable.
- Outcomes are assessed and amended throughout the person’s lifetime with MS.

**Planning**

- The MS nurse develops a plan of care that prescribes interventions to attain expected outcomes.

**MEASUREMENT CRITERIA**

- The plan is individualized to the patient in terms of age, cultural and ethnic background, level of education, and needs.
The plan is developed collaboratively with the patient, family, and other team members.
- The plan is comprehensive and addresses current and potential problems, as well as the maintenance of health and wellness and the prevention of complications.
- The plan reflects current MS practice.
- The plan is evolving and can be adapted to address changes.
- The plan provides for continuity of care.
- Priorities for care are established.
- The plan is documented.

**Implementation**

- The MS nurse implements the interventions identified in the plan of care.

**MEASUREMENT CRITERIA**

- Interventions are consistent with the established plan of care.
- Interventions are implemented in a safe, timely, and appropriate manner.
- Interventions are reviewed and modified on the basis of patient progress or change in condition.
- Interventions are documented.
- Interventions are derived using a team approach.

**Evaluation**

- The MS nurse evaluates the patient’s progress toward attainment of outcomes.

**MEASUREMENT CRITERIA**

- Evaluation is systematic, ongoing, and criterion based.
- The patient, family, and other MS team members are involved as appropriate.
- Ongoing assessment data are used to revise the plan of care, interventions, and accomplishment of appropriate outcomes.
- Revisions are documented and communicated to the patient, family, and other team members.
The effectiveness of interventions is evaluated in relation to outcomes.
The patient’s responses to interventions are documented.

PROFESSIONAL PERFORMANCE

Quality of Care
The MS nurse systematically evaluates the quality of effectiveness of MS nursing practice.

MEASUREMENT CRITERIA
The nurse participates in quality of care/performance improvement activities such as the following:
A. Identifying aspects of care that are important for quality monitoring
B. Identifying indicators used to monitor quality and effectiveness of nursing care
C. Collecting data
D. Analyzing quality data
E. Formulating recommendations to improve nursing practice or patient outcomes
F. Participating in interdisciplinary MS care
G. Implementing activities to enhance the quality of MS nursing practice
H. Developing policies and procedures to improve quality of care.

The nurse uses the results of quality of care/performance improvement activities to initiate change in practice.
The nurse uses the results of activities to initiate change throughout the health care system when appropriate.

Performance Appraisal
The MS nurse evaluates nursing practice in relation to professional standards and relevant statutes and regulations.
The nurse engages in performance appraisal on a regular basis.
The nurse seeks constructive feedback.
The nurse takes action to achieve goals identified in performance appraisals.
The nurse participates in peer review.
The nurse’s practice reflects knowledge of current professional standards, laws, and regulations.
Education

- The MS nurse acquires and maintains current knowledge and competency in nursing practice.

MEASUREMENT CRITERIA

- The nurse participates in ongoing educational activities.
- The nurse seeks experiences that reflect current clinical practice to maintain current clinical skills and competency.
- The nurse acquires knowledge and skills appropriate to the specialty and practice setting.

Collegiality

- The MS nurse interacts with peers and other colleagues and contributes to their professional development.

MEASUREMENT CRITERIA

- The nurse shares knowledge and skills with colleagues.
- The nurse provides colleagues with constructive feedback.
- The nurse interacts with colleagues to enhance MS nursing practice.
- The nurse facilitates the education of nursing and other health care students.
- The nurse promotes a supportive, safe, and healthy work environment.

Ethics

- The MS nurse’s decision and actions on behalf of patients are determined in an ethical manner.
- The nurse maintains patient privacy and confidentiality within legal and regulatory parameters.
- The nurse acts as a patient advocate and assists the patient to develop skills to advocate for himself or herself.
- The nurse delivers care in a nonjudgmental and nondiscriminatory manner and is sensitive to patient diversity, including age-related and cultural issues.
- The nurse delivers care in a manner that preserves patient autonomy, dignity, and rights.
- The nurse seeks available resources in formulating ethical decisions.
Collaboration

- The MS nurse collaborates with the patient and other health care providers in providing care.
- The nurse communicates with the patient, family, and other members of the health care team.
- The nurse collaborates to develop goals, plan of care, and decisions related to delivery of care.
- The nurse consults with other health care providers as needed.
- The nurse makes referrals to ensure continuity of care as needed.

Research

- The MS nurse integrates research findings into practice.
- The nurse uses evidence-based guidelines and research data in nursing practice.
- The nurse participates in research activities, as appropriate to the nurse’s education and position. Such activities may include the following:
  A. Identifying clinical problems suitable for nursing research
  B. Participating in data collection
  C. Participating in collaborative research activities
  D. Disseminating research findings
  E. Conducting research
  F. Critiquing research for application to practice
  G. Using research in the development of policies and procedures.

Resource Utilization

- The MS nurse considers factors related to safety, effectiveness, and cost in planning and delivering patient care.

MEASUREMENT CRITERIA

- The nurse evaluates factors related to safety, effectiveness, availability, and cost to determine practice options that would result in the same patient outcome.
- The nurse assists the patient and family in identifying and securing appropriate and available services for health-related needs.
- The nurse assigns or delegates tasks as defined by the state nurse practice acts and according to the knowledge and skills competency of the designated caregiver.
If the nurse assigns or delegates tasks, it is based on the needs and condition of the patient, the potential for harm, the stability of the patient’s condition, the complexity of the task, and the predictability of the outcome.

The nurse assists the patient and the family to become informed consumers about the costs, risks, and benefits of treatment and care.

THE MULTIPLE SCLEROSIS SPECIALIST NURSE ASSOCIATION

Competencies for MS Specialist Nurses

The role of the MS specialist nurse, as defined by the United Kingdom organization representing MS specialist nurses (2003), is to “empower those affected by MS by providing information, support and advice about the condition from time of diagnosis and through the disease spectrum. The MS specialist nurse is pivotal in providing a greater understanding of the condition, and by adopting a holistic, collaborative and coordinated approach to help those individuals, where possible, reach their goals of self-management. The role involves acting as a consultant, an educational resource for staff, and striving towards great awareness and knowledge of MS in the health and social arena.”

Levels of competency were defined as follows:

A. Novice
B. Competent
C. Expert

Timelines were for the following:

A. Novice up to 9 months from starting
B. Competent 9 months onward
C. Expert depending on the ability of the individual and working environment

Areas of competency consisted of the following:

A. Clinical management of MS
   1. Diagnostic phase
   2. Minimal impairment phase
   3. Moderate disability phase
   4. Severe disability phase

B. Knowledge of MS
   1. Etiology of the disease
   2. Classification of disease course
3. Pathology of the disease
4. Comprehensive management
   a. Relapses
   b. Symptoms
   c. Treatment options
   d. Complementary therapies
   e. Possible adverse events
5. Outcome measurement
6. Cognitive impact
C. Relationships with people with MS and their families
   1. Trust and self-management
   2. Advocacy
   3. User service development
   4. Telephone management relationships and time management
D. Personal planning and organization
   1. Time management
   2. Administration support
E. Working in different health and social environments
   1. Integration and development of services
   2. Community and primary care etiquette
F. Accountability
   1. Scope of practice
   2. Accountability for service demands
   3. Documentation
   4. Evidence-based practice
   5. Informed consent
G. Teaching and sharing knowledge
   1. Development of educational programs
   2. Teaching
   3. Use of evaluation tools
   4. Mentorship
   5. Teaching people with MS
H. Audit
   1. Using research
   2. Doing research
3. Patient trials
4. Audit

I. Relationships with professionals
   1. Partnerships
   2. Influence and leadership
   3. Professional networking
   4. Relationships with industry

J. Professional and personal development
   1. Reflective practice
   2. Developing knowledge

RESOURCES


OBJECTIVES

Upon completion of this chapter, the learner will be able to:

- Discuss relapse management in multiple sclerosis (MS)
- Describe U.S. Food and Drug Administration–approved disease modification in relapsing forms of MS
- List treatment patterns using off-label therapies, and describe strategies to promote adherence to complex protocols

Relapse management

A. A relapse is the appearance of a new symptom or the reappearance of a previous symptom of multiple sclerosis (MS) after the initial attack. A relapse cannot be related to an intercurrent infection or any other environmental factors and must last more than 24 hours.

B. In clinical practice, relapses are usually managed with high-dose intravenous or oral corticosteroids for a limited amount of time:
   1. Methylprednisolone
   2. Prednisone
3. Dexamethasone  
4. Adrenocorticotropic hormone (ACTH)  
5. Medrol  

C. No proof of benefit on relapse rates and progression. Corticosteroids are known to shorten the duration of the relapse, but may not affect the overall disease course. Chronic steroids are not recommended because of lack of evidence of benefit and side effects (hematologic effects, bone loss, and increased susceptibility to infection).  

D. Minimal evidence on optimal dose or regimen.  
E. Protocols vary from country to country.  

- Immunosuppressant therapies  
  A. Azathioprine (oral) not approved for MS  
     1. Was used a great deal in the 1970s before injectable medications were approved  
     2. Recent evidence suggests slight effect on disease activity when compared with an interferon product  
     3. Recommendation not to exceed 600 mg daily in view of possible risk of malignancy  
  B. Cyclophosphamide (intravenous or oral) not approved for MS  
     1. Conflicting studies  
     2. High adverse-effect profile  
     3. Many varying protocols  
     4. May be used for “rescue therapy”  
     5. There are dose-related toxicities  
  C. Methotrexate (oral) not approved for MS  
     1. Paucity of evidence of effectiveness, including MRI  
     2. Weekly low dose may help delay progression in progressive MS  
     3. Research demonstrates modest effect on upper-extremity function  
     4. Must be taken daily with folic acid  
     5. Anecdotal reports of use of combination therapy  
  D. Mitoxantrone (intravenous)  
     1. Studied widely in Europe  
     2. Approved by the U.S. Food and Drug Administration for worsening forms of relapsing MS  
     3. Used in aggressive, relapsing MS and in patients with inadequate response to disease-modifying agents (DMAs)  
     4. Has lifetime maximal dose
5. Potential for cardiotoxicity
6. Documented risk for leukemia

E. Intravenous immunoglobulin not approved for MS
   1. Obtained from blood of healthy human donors
   2. Several studies with conflicting results
   3. Used in Devic syndrome (neuromyelitis optica spectrum disorder)
   4. Well tolerated
   5. Very costly

Approved disease-modifying therapies (DMTs)

A. Therapies becoming available worldwide
B. Reimbursement for costs varies widely throughout states in the United States and provinces of Canada
C. In most countries, available for relapsing MS
D. Therapy initiation and ongoing adherence require nursing services (documented in research)

E. Available therapies
   1. Interferon-β (1b, 1a intramuscular and subcutaneous)
   2. Glatiramer acetate
   3. Natalizumab
   4. Fingolimod
   5. Teriflunomide
   6. Dimethyl fumarate
   7. Alemtuzumab

F. Interferon-β 1b (Betaseron or Betaferon or Extavia)
   1. 8 MIU subcutaneously every other day
   2. Requires reconstitution
   3. Diluent available in prefilled syringe
   4. Autoinjector for injection
   5. Benefit in relapse rates and MRI
   6. Preliminary data on cognition and depression
   7. In secondary-progressive MS, North American study was not statistically significant; in Europe, the results were positive
   8. Delayed onset of clinically definite MS by 1 year in BENEFIT trial
   9. Approved for clinically isolated syndrome (CIS) patients
   10. No clinical benefit found by studies comparing interferon-β to glatiramer acetate, although MRI benefit seen (BECOME and BEYOND studies)
11. Side-effect profile:
   a. Flu-like syndrome
   b. Skin reactions and rare necrosis
   c. Menstrual changes, abortifacient potential
   d. Reports of depression (refuted in 2002, Feinstein, O’Connor, & Feinstein)
   e. Neutralizing antibodies 38%
   f. Leukopenia
   g. Elevated liver enzymes
   h. Thrombocytopenia

12. Side-effect management includes patient and family education in dose titration, timing of injections, nonsteroidal anti-inflammatory drugs (NSAIDs), site rotation, management of depression

13. Regular blood work important more frequently initially and at regular intervals thereafter

G. Interferon-β 1a (Avonex)
   1. 30 mcg (6 MIU) intramuscular injection once weekly—prefilled syringe
   2. Slows progression measured by Expanded Disability Status Scale (EDSS) in relapsing MS
   3. Reduces relapses by 18%
   4. Delays onset of Certification of Disability Management Specialists (CDMS) by 1 year (monosymptomatic trial-CHAMPS); approved for CIS
   5. No clear benefit in secondary-progressive MS
   6. Benefit in brain atrophy reported
   7. Side effects include:
      a. Flu-like syndrome
      b. Cautious use with seizures or depression
      c. Abortifacient potential
      d. Neutralizing antibodies
      e. Elevated liver enzymes
   8. Side-effect management includes patient and family education, timing of injections, NSAIDs, site rotation, and management of depression

H. Interferon-β 1a (Rebif)
   1. Two doses (22 and 44 mcg) three times weekly subcutaneously
   2. Prefilled syringes with autoinjector (Rebiject)
3. Dose-dependent decrease in relapse and MRI disease burden
4. Delayed onset of clinically definite MS by 9 months (ETOMS study)
5. Side effects include:
   a. Flu-like syndrome
   b. Site reactions and rare necrosis
   c. Menstrual irregularities
   d. Leukopenia, elevated liver enzymes, and thrombocytopenia
   e. Neutralizing antibodies
   f. Possible depression, although this was refuted in a recent study
6. Side-effect management includes patient and family education in dose titration, timing of injections, NSAIDs, site rotation, and management of depression

I. Glatiramer acetate (Copaxone; combination of four amino acids)
   1. 20 mg subcutaneously daily
   2. In prefilled syringe with autoinjector
   3. Sustained benefit in reduction of relapse rate
   4. Significant reduction of MRI lesion number and volume
   5. No benefit for primary progressive MS (PROMISE trial)
   6. No statistical significance in oral form (CORAL trial)
   7. PreCISE trial demonstrated benefit in CIS; medication approved for early disease
   8. Side effects include:
      a. Injection site reaction, hives, and pain
      b. Rare systemic reaction (chest pain, dyspnea, and anxiety—postinjection reaction)
      c. Arthralgia and nausea

J. Common problems with disease modifying therapies (DMTs)
   1. Spasticity
      a. Can be seen in patients with greater disability
      b. Commonly seen with interferon therapy
      c. May occur on initiation of therapy or prior to treatment
      d. Differential diagnosis between interferon-induced spasticity and spasticity associated with relapse or infection is necessary
      e. Assess for other contributing factors
      f. Administer antispasticity medications
      g. Consider dose adjustment of interferons until problem is managed
2. Laboratory abnormalities
   a. No known significant abnormalities with glatiramer acetate
   b. In interferon therapy, the most common abnormalities are leukopenia, neutropenia, and raised liver aminotransferase values (e.g., serum glutamic oxaloacetic and serum glutamic pyruvic transaminase)

3. Managing laboratory abnormalities
   a. Monitor laboratory values regularly following initiation of treatment, and yearly thereafter
   b. Inform physician of abnormal values
   c. Consider dose adjustment and/or discontinuation of treatment if abnormalities persist

4. Depression
   a. Common in MS
   b. Conflicting data about relationship to interferon therapy
   c. Expert opinion is to treat depression before starting DMTs

K. Natalizumab (intravenous)
   1. Monoclonal antibody designed to interfere with movement of potentially damaging immune cells across the blood–brain barrier.
   2. Showed significant reduction of annual relapse rate (68% reduction), sustained progression and reduction in both new T2 lesions (83%) and gadolinium-enhancing MRI lesions (92%).
   3. Side effects include headache, fatigue, urinary tract infections, joint pain, and abdominal discomfort.
   4. Voluntarily withdrawn from market because of serious adverse events of progressive multifocal leukoencephalopathy (PML) after approval in 2004; withdrawn in 2005; rereleased in 2006 with safety monitoring in place in North America. PML is a serious, potentially disabling, or fatal brain infection caused by the John Cunningham (JC) virus. The JC virus is a common virus that is harmless in most people, but can cause PML in a small number of people treated with certain types of MS drug therapies, and is thought to be due to an unusual immune response to the JC virus.
   5. Given every 4 weeks by infusion.
   6. Patients should be screened for signs and symptoms of premenstrual syndrome (PMS; altered mental status, altered function, and depression) before each infusion, along with monitoring for systemic infection.

L. Fingolimod (Gilenya)
   1. Oral immunomodulator/immunosuppressant taken once daily
2. Sequesters mainly T lymphocytes in lymph nodes, which is reversed when drug is discontinued
3. Showed reduction in relapse rate, MRI indicators of disease activity, and impact on brain atrophy
4. Recommended screening prior to initiation of therapy includes ophthalmology, cardiology, and dermatology if there is a family history of skin malignancies
5. Patients must be tested for rubella antibodies; if negative, must have immunization and wait 2 months to start the medication
6. Bradycardia occurs with the first dose; therefore, a 6-hour monitoring period is in the labeling of the medication
7. Other side effects include headache, hypertension, breathlessness, decreased resistance to infection, visual blurring, and ocular pain (macular edema must be ruled out)
8. There have been several occurrences of PML
9. Routine follow-up blood work that includes complete blood count (CBC), creatinine, alkaline phosphatase, bilirubin, TSH, follow-up eye exams, and pulmonary function tests where appropriate

M. Teriflunomide
1. Active metabolite of leflunomide, FDA-approved for rheumatoid arthritis
2. An oral immunomodulator with anti-inflammatory activity inhibits pyrimidine synthesis by binding to the enzyme dihydro-orotate dehydrogenase
3. Inhibits rapidly dividing cell populations and is nonspecific to T cells
4. Teriflunomide 14 mg taken once daily showed impact on relapse rate and MRI indicators of disease activity
5. Side effects include elevated liver enzymes, gastrointestinal disturbance, lymphopenia, and hair thinning
6. Teratogenic for men and women
7. Monthly CBC and liver function tests (LFTs) for at least 6 months recommended
8. Slow excretion of this medication, not dialyzable, and present in blood levels for 8 to 24 months after discontinuation
9. Accelerated elimination is available with cholestyramine 8 g, po q8 hours × 11 days or activated charcoal 50 g po q12 hours × 11 days

N. Dimethyl fumarate (DMF)
1. First approved to treat psoriasis in the form of Fumarate
2. In MS, acts as immunomodulator, and experimental evidence suggests that DMF may provide anti-inflammatory and cytoprotective effects in the treatment of MS
3. Oral medication given in doses of 240 mg twice daily as tolerated in DEFINE and CONFIRM trial
4. Showed impact on relapses and MRI indicators of disease activity
5. Side effects include generalized flushing and GI disturbances, including diarrhea and intestinal cramping and bloating
6. There have been several occurrences of PML
7. Regular blood work includes CBC, creatinine, alkaline phosphatase, bilirubin, TSH, and urinalysis for presence of protein

O. Alemtuzumab
1. Alemtuzumab, a humanized monoclonal antibody, has shown efficacy for relapsing–remitting multiple sclerosis in phase 2 and phase 3 trials. Compared with subcutaneous interferon β-1a, alemtuzumab significantly reduced the risk for accumulation of disability and the rate of relapse, and improved mean disability level from baseline.
2. Side effects include infusion-associated reactions, infections of predominantly mild-to-moderate severity, and autoimmune adverse events (principally, thyroid disorders and immune thrombocytopenia).
3. Pivotal trials showed reduction of annual relapse rate of 55% and decreased worsening of progression as compared with beta interferon 1a by subcutaneous injection.
4. Alemtuzumab 12 mg intravenous infusion is given once a day for 5 days, followed 1 year later by 12 mg intravenous infusion once a day for 3 days.
5. Patients require prescreening immunizations and blood work as well as regular postinfusion blood monitoring including CBC, creatinine, alkaline phosphatase, bilirubin, and thyroid stimulating hormone (TSH)—monthly for 48 months following last infusion.

Emerging therapies and therapies under review
A. Laquinimod—in investigation
1. Oral medication that appears to modulate cytokine balance in favor of \( \text{T}_{\text{H}}2/\text{T}_{\text{H}}3 \) cytokines (anti-inflammatory)
2. ALLEGRO study showed reduction in relapse rate and EDSS progression
3. BRAVO trial compares laquinimod with placebo and interferon-β 1a
4. CONCERTO, a follow-up phase III study, scheduled for completion in 2018, will examine disability progression in participants treated with placebo, 0.6 mg laquinimod, or 1.2 mg laquinimod
5. Main adverse effect appears to be self-limited, dose-dependent increase in liver enzymes

B. Ocrelizumab (submitted to FDA for approval)
1. An anti-CD 20 monoclonal antibody that lyses circulating B cells.
2. Both the OPERA I and II studies in relapsing–remitting MS and the ORATORIO trial in primary progressive MS met primary end points.
3. The OPERA studies suggested ocrelizumab may be a highly effective agent in relapsing–remitting MS, but without the serious adverse effects seen with other, similarly potent agents.
4. ORATORIO trial is the first phase 3 study to show a slowing of disability progression in primary progressive MS.
5. Medication is well tolerated.

C. Autologous hematopoietic stem cell transplantation
1. Bone marrow transplantation, with a patient’s own bone marrow stem cells, is an aggressive and risky treatment that is currently reserved for a small subgroup of patients with early aggressive MS that does not respond to other therapies.
2. Results of trials have shown that most patients had no further relapses and no new lesions visible by MRI for 2 years following the treatment, but the progressive process does continue.
3. Most cells of the immune system were restored following the treatment, including the types of T cells that can react to myelin in the brain (autoreactive T cells). Another type of cell, known as T_H17, remained reduced in number following the procedure, and T_H17 immune function did not return to normal.
4. T_H17 cells are known to be involved in crossing the blood–brain barrier and may assist other immune cells such as inflammatory T_H1 cells and autoreactive T cells to enter the brain.
5. Research is ongoing and is being used as rescue therapy in some centers throughout the world.
Initiation of therapy: Sustaining adherence

A. Neurologists, advanced practice nurses, physician assistants, and primary care physicians may be involved in treatment decisions. Regardless of who makes the decision, it is imperative that the nurse educate the patient and family on the following:
1. All available treatments
2. Efficacy and side effects
3. Self-care activities
4. The importance of adherence

The psychoeducational approach

A. Requires that the patient and family become actively involved in goal setting, realistic expectations, and the process itself

B. Patient and family education requirements
1. Information is provided in a clear and concise manner.
2. A relaxed and nondistracting learning environment is available.
3. A variety of educational tools are used.
4. Reinforcement is provided regularly.
5. Education should not be initiated immediately after diagnosis.
6. Hope can be instilled along with realistic expectations.
7. Patients must be motivated to learn; if they are not ready, education should be delayed.
8. Educational strategies must take into account patient’s age, cultural and educational background, and previous experience with the health care system.
9. Outcomes of education; patients should be able to
   a. Describe rationale of therapy
   b. Correctly reconstitute and administer medication
   c. Manage side effects
   d. Identify and use resources to obtain further information
10. Promoting adherence
   a. Establishment of a trusting relationship
   b. Consistent and clear education
   c. Advocacy for access to treatment
   d. Reinforcement by the multidisciplinary team during ongoing patient and family contact
RESOURCES


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