NURSE'S QUICK

reference

CARING FOR PATIENTS WITH MULTIPLE SCLEROSIS

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DISCLAIMER:

The Nurse's Quick Reference serves only as a guide for nurses caring for patients with multiple sclerosis. It is not meant to substitute for individualized assessment and treatment by a physician, or personalized instructions and recommendations by the nurse.

For Jayne Dystel in memory of her brother, John Jay Dystel.

John Jay Dystel

(1946–2003)

John Jay Dystel typified individuals who live with multiple sclerosis: diagnosed in the prime of his life, John's promising law career was curtailed by the ravages of this disease. Yet, he remained a cheerful and hopeful man who, with his family, recognized the essential role that basic and clinical research play in discovering answers to MS.

Oscar and Marion Dystel, John's parents, established the John Dystel Multiple Sclerosis Research Fund at the National Multiple Sclerosis Society as a means of supporting research that will fulfill everyone's hope that stopping MS progression, restoring lost function, and ending MS forever will soon be possible; and the John Dystel Multiple Sclerosis Fellowships that are designed for registered nurses, nurse practitioners, and physician assistants who are interested in receiving advanced training in MS care.

All these efforts contribute to creating a world free of multiple sclerosis.

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NO. 1

Multiple Sclerosis: Overview

Multiple sclerosis (MS) is a chronic, immune-mediated disease that affects the central nervous system (CNS). The etiology of MS remains unknown. The most widely accepted hypothesis is that it is an autoimmune disease induced by a virus or other infectious agent in a genetically-susceptible individual.

The myelin sheath surrounding certain nerve fibers becomes damaged (demyelination), interrupting the conduction of nerve impulses and causing a wide variety of symptoms. Axonal loss and tissue atrophy also occur within the brain and spinal cord.

The many sites where myelin is lost appear as hardened sclerotic areas (also called scars, plaques, lesions) — giving the disease its name. Multiple sclerosis literally means many scars.

Tables 1A and 1B show the pathophysiologic basis of MS. *Table 1A* describes the normal functioning of the central nervous system; *Table 1B* describes what occurs as a result of the disease process.

TABLE 1A — PATHOPHYSIOLOGIC BASIS OF MS

WHAT IS NORMAL?
Anatomy and Physiology The nervous system is composed of the central nervous system (brain and spinal cord) and peripheral nervous system. The neuron (also called *nerve cell*) is the structural and functional unit of the nervous system. It consists of a cell body (perikaryon) and its processes: the *axon* (which conducts impulses away from cell body) and *dendrites* (which conduct impulses toward the cell body). Myelin, produced by a specific type of cell called an *oligodendrocyte*, is a fatty material that insulates nerves, acting like the covering of an electrical wire to allow the nerve to transmit its impulses rapidly and smoothly. It is the speed and efficiency with which these impulses are conducted that permits coordinated movements that are performed with little conscious effort. **The Immune System** The immune system is a network of special cells and organs that function to prevent pathogens ("foreign invaders") — bacteria, viruses, other micro-organisms — from infecting the body. Its crucial function is to distinguish "self" from "non-self." These abilities are innate or adaptive.

Innate immunity — includes skin, tears, and mucus, which bar the entry of pathogens into the body. It mainly relies on macrophages that destroy the invading pathogens (antigens).

Adaptive immunity — targets antigens that evade or overwhelm innate immunity. The key players go after only specific pathogens, able to recognize them if they attack the body repeatedly.

- T-cells — further grouped by function:
  - helper T (Th) cells — Th1 and Th2 normally regulate each other with chemical messenger cells called cytokines.
  - killer or cytotoxic T cells
  - suppressor T cells
- B-cells — make antibodies (or immunoglobulins) against specific pathogens of T cells. Antibodies block the pathogens before they enter cells and mark them for destruction.

Blood-brain barrier

The blood-brain barrier (BBB) is an immunologic barrier that maintains the integrity of the CNS.

TABLE 1B

WHAT IS ABNORMAL? (WHAT HAPPENS IN MS?)

Altered Physiology

MS appears to involve an immune-mediated inflammatory process in the CNS. In the majority view, MS is thought to involve misguided activity by Th1 cells and is immune-dysregulation.

Infection is often hypothesized to be an MS trigger ("molecular mimicry") specifically through an unfortunate resemblance between a pathogen and a host antigen.

A breakdown occurs in the blood-brain barrier, allowing immunologically active cells in the blood to enter the brain and cause patchy damage to myelin.

The oligodendrocyte and myelin appear to be injured in MS. Damage to myelin (demyelination) can lead to an injury to the axon.

Consequently, plaques or lesions form along the myelin sheath resulting in interference with nerve conduction, causing a short-circuiting and disruption of electrical transmission.

When myelin is damaged, messages between the brain and other parts of the body are interrupted. The resulting symptoms vary widely and include blurred vision, weak limbs, tingling sensations, unsteadiness and fatigue, bladder and bowel dysfunction, sexual dysfunction, mood and cognitive changes, among others. For some people, MS is characterized by periods of relapse and remission while for others it has a progressive pattern.

Some degree of remyelination occurs naturally in MS, although it is generally very slow. This remyelination explains some of the recovery of function that occurs during remission. The remyelinated axons may appear to be functioning normally, as the symptoms have cleared, but electrophysiological measurements (evoked potential studies) often show that conduction is slower than normal. Perhaps more important in the long-term is the amount of damage that occurs to the axons. Axons that are damaged or destroyed do not repair themselves, which is thought to explain the permanent disability that occurs in many people with MS.

KEY FACTS ABOUT MS

- Over 2.1 million people around the world have MS.
- The estimated prevalence in the United States is more than 400,000.
- The incidence rate in the United States is 10,000 new cases per year.
- The risk of developing MS in the general population is 1 in 750.
- MS is not directly inherited although genetic susceptibility plays a part in its development; the risk in a person with a close relative who has MS increases from 1 in 750 to 1 in 40; the risk for an identical twin is approximately 1 in 25–30.
- The disease is more common in women than men with a ratio of 2–3 :1.
- People are most commonly diagnosed between 20 and 50 years of age; ninety percent of those diagnosed are between the ages of 16 and 60. MS has been known to make its first appearance in early childhood or after age 60.
- MS occurs in most ethnic groups, including African-Americans, Asians and Hispanic/Latinos, but is more common in Caucasians of Northern European ancestry.
- The incidence of MS increases in countries further from the equator. In the northern hemisphere, a diminishing north-south gradient has been well described. In the southern hemisphere, the reverse has been reported.
- Studies have indicated that where in the world one lives earily in life influences the risk of developing MS. Epidemiologic data from migration studies suggest that some factor — most likely infectious — encountered before puberty probably triggers the disease.
- People who are born in an area of the world with a high risk of MS, and move to an area of lower risk before age 15, acquire the risk level of their new home.
- MS is not contagious.
- There is a 66% decrease in relapse rate during pregnancy and a 20–40% increased risk of relapse for up to 6 months postpartum.
- Lifespan is not significantly affected for most people with MS.

NO. 2

Clinical Courses/ Types of MS

The course of MS is unpredictable. Some people are minimally affected by the disease while others experience severe, progressive disability; the majority of people fit between these two extremes. The following table shows the standardized terminology used to describe the clinical courses of MS.

TABLE 2: DISEASE COURSES

TYPE	DESCRIPTION
Relapsing-Remitting MS (RRMS)	Characterized by exacerbations (relapses or attacks) followed by partial or complete recovery periods (remission), and no disease progression between exacerbations. *85% of people begin with this course.*
Primary-Progressive MS (PPMS)	Characterized by slowly worsening neurologic function from the beginning — with no distinct relapses or remissions. *10% of people begin with this course.*
Secondary-Progressive MS (SPMS)	Characterized by an initial period of relapsing-remitting MS followed by a steadily worsening disease course with or without occasional exacerbations, minor recoveries, or plateaus. *50% of people with RRMS will convert to SPMS within 10 years.*
Progressive-Relapsing MS (PRMS)	Characterized by a steadily worsening disease from the onset, with occasional, acute relapses, with or without recovery. In contrast to RRMS, the periods between relapses are characterized by continuing disease progression. *Occurs in fewer than 5% of cases.*

"BENIGN MS"

After many years, it may be evident that some patients have had a very long mild course that can be considered benign. Benign MS represents about 10% of cases, but it can only be recognized retrospectively — after approximately 20 years have passed.

RELAPSE/EXACERBATION

Relapses are also referred to as exacerbations, attacks, or flare-ups. A relapse is defined as the appearance of a new neurologic abnormality or a subacute worsening of an existing MS symptom(s), which is present for at least 24 hours in the absence of a metabolic etiology (e.g. fever or infection) and is separated from a previous exacerbation by at least one month.

PSEUDO-EXACERBATION

A pseudo-exacerbation is unrelated to new disease activity. It results from some other trigger, such as a fever, infection, pain, or heat that can temporarily aggravate MS problems. Once the triggering event is past (e.g. the body temperature returns to normal) the symptoms subside as well. Pseudoexacerbations can last a few minutes or hours (e.g., following overheating due to exercise or hot weather) or a few days (e.g., because of fever related to an infection).

REMISSION

A remission does not necessarily mean that all the symptoms of MS disappear, but rather that a person with MS has some degree of improvement as the inflammatory episode subsides; in other words, recovery may be partial or complete.

NO. 3

Diagnosis

The diagnostic criteria for MS have been evolving for over 50 years. At this time, no single test is available to identify or rule out MS. The diagnosis of MS is a clinical one, requiring evidence of dissemination in time and space. In other words, there must be objective evidence of two episodes of demyelination in the CNS that are separated in time (by at least one month) and in space (as evidenced by areas of inflammation or damage in separate areas of the CNS). In addition, other conditions that mimic MS, such as infectious, metabolic and vascular illnesses must be ruled out.

THE FOLLOWING ARE USED IN THE DIAGNOSTIC WORK-UP

- Medical History — overall view of the individual's health picture
- Neurologic Examination *(See Chapter 4)*
- Laboratory Tests: magnetic resonance imaging, evoked potentials, lumbar puncture

MEDICAL HISTORY

A careful history is taken to identify past and present symptoms that may be caused by MS. A medical history can include the following questions: Describe your current symptoms, what do they feel like and where on the body do they occur? How long have you had these symptoms? Have they ever gone away? How do you manage your symptoms? Do you remember any episodes of unusual changes or symptoms that appeared for awhile and then disappeared? Do you have other medical issues? What is your family history of illness? Where did you grow up and where have you traveled to in your lifetime?

LABORATORY TESTS

Magnetic Resonance Imaging (MRI)

MRI is the tool that currently offers the most sensitive non-invasive way of imaging the brain, spinal cord, or other areas of the body. It facilitates an early diagnosis and is exquisitely sensitive for detecting new inflammatory lesions. It does not use radiation, making it safe for repeated use. The MRI markers of acute inflammation are gadolinium-enhancing lesions, or new and enlarging T2 lesions. Gadolinium normally does not enter in the brain unless there is blood vessel leakage (a break in the blood-brain barrier) as seen with tumors, abscesses, or active MS lesions. It should be remembered, however, that approximately 5% of patients with clinically definite MS do not show lesions on brain MRI at the time of diagnosis, and the absence of demyelination on MRI does not rule out MS. MRI findings can support the diagnosis of MS in a patient with appropriate and clinical findings, at the exclusion of alternative diagnoses.

Evoked Potential (EP)

EP tests measure the electrical activity of the brain in response to stimulation of specific sensory nerve pathways. Like the MRI, this test is noninvasive and virtually painless. The 3 types of EP commonly used are: visual evoked potentials (VEP — eyes are stimulated by looking at a pattern such as a checkerboard with bright lights); brainstem auditory evoked potentials (BAEP — using earphones, hearing is stimulated by listening to a clicking tone); and sensory evoked potentials (SEP — nerves of arms and legs are stimulated by a mild electrical pulse). The current diagnostic criteria for MS consider only VEP findings. VEPs are used to identify impaired transmission along the optic nerve pathways, which is a fairly common early finding in MS — even in someone who has never been aware of any visual symptoms. This test is not specific for MS. Other conditions can produce abnormal results. The information the tests provide needs to be considered along with other laboratory and clinical information before a diagnosis of MS can be made.

Lumbar Puncture (LP)

In an LP (also known as a spinal tap), the cerebrospinal fluid (CSF) — the fluid that bathes the spinal cord and brain — is collected for analysis using a hollow needle to penetrate the spinal canal at the level of L3-4 or L4-5 vertebrae. In performing this test, the physician is looking for (1) elevations in IgG (immunoglobulin G, a protein fraction of gamma globulin), and other proteins that are indicative of some abnormality in the immune system or blood brain barrier; (2) the presence of a specific IgG clusters that appear in the spinal fluid as oligoclonal bands; and (3)an IgG index that shows whether abnormal immunoglobulins are produced in the spinal fluid area or in the blood outside the nervous system. None of these is specific for MS, making a lumbar puncture primarily useful for confirming the diagnosis of MS when there is uncertainty about other causes such as vascular disease. Spinal fluid may also be normal in a minority of people diagnosed with MS.

Diagnosis Incorporating McDonald Criteria

The "McDonald Criteria" (named after Dr. W. Ian McDonald) were first presented in 2001 by the International Panel on the Diagnosis of Multiple Sclerosis. The intent was to present a diagnostic scheme that could be used by the practicing neurologist to better and more reliably diagnose MS. The criteria were revised in 2005, and again in 2010 to simplify and streamline the diagnostic process, while maintaining adequate sensitivity and specificity. The McDonald Criteria have been generally adopted by the MS community around the world. *(See Tables 3A and 3B).*

"Clinically-Isolated Syndrome "

A clinically-isolated syndrome (CIS) is a single clinical event that is suggestive of demyelination (e.g. an attack of optic neuritis in one eye, or an episode of numbness on one side, transverse myelitis, or brain stem insult) that is unaccompanied by any other clinical signs or symptoms.

Individuals who experience a clinically isolated syndrome may or may not go on to develop MS. The challenge for the physician is to determine the likelihood that a person experiencing this type of demyelinating event is subsequently going to develop MS. Studies have shown that when the CIS is accompanied by MRI-detected brain lesions that are consistent with those seen in MS, there is a high risk of a second neurologic event, and therefore a diagnosis of clinically definite MS, within several years. Individuals who experience CIS with no evidence of MRI-detected lesions are at lower risk for developing MS over the same time period.

TABLE 3A — 2010 REVISED MCDONALD MS DIAGNOSTIC CRITERIA[1]

Diagnosis of MS requires demonstration of dissemination of lesions in space (DIS) and time (DIT)* and elimination of other possible diagnoses.

Clinical (Attacks)	Lesions	Additional Criteria to Make DX
2 or more	Objective clinical evidence ≥ 2 lesions or objective clinical evidence of 1 lesion with reasonable historical evidence of a prior attack	None. Clinical evidence alone will suffice; additional evidence desirable but must be consistent with MS
2 or more	Objective clinical evidence of 1 lesion	DIS; *OR* await further clinical attack implicating a different CNS site
1	Objective clinical evidence of ≥2 lesions	DIT; *OR* await a second clinical attack
1	Objective clinical evidence of 1 lesion	DIS *OR* await further clinical attack implicating a different CNS site *AND* DIT; *OR* await a second clinical attack
0 (progression from onset)		One year of disease progression (retrospective or prospective) *AND* at least two of the following: DIS in the brain based on ≥1 T2 lesion in periventricular, juxta-cortical or infratentorial regions; DIS in the spinal cord based on ≥2 T2 lesions; or positive CSF

1. Polman et al. Diagnostic criteria for multiple sclerosis: 2010 revisions to the McDonald Criteria. Ann Neurol 2011;69:292–302.

**See Table 3B for DIS and DIT*

TABLE 3B — PARACLINICAL EVIDENCE IN MS DIAGNOSIS

Evidence for Dissemination of Lesions in Space (DIS)[2]
≥ 1 T2 lesion in at least two out of four areas of the CNS: periventricular, juxtacortical, infratentorial, or spinal cord ■ Gadolinium enhancement of lesions is not required for DIS ■ If a subject has a brainstem or spinal cord syndrome, the symptomatic lesions are excluded and do not contribute to lesion count
Evidence for Dissemination of Lesions in Time (DIT)[3]
■ A new T2 and/or gadolinium-enhancing lesion(s) on follow-up MRI, with reference to a baseline scan, irrespective of the timing of the baseline MRI *or* ■ Simultaneous presence of asymptomatic gadolinium-enhancing and non-enhancing lesions at any time
Evidence for Positive CSF
Oligoclonal IgG bands in CSF (and not serum) or elevated IgG index

2. Swanton KL et al. Lancet Neurology 2007;6:677-686 / Swanton KL et al. J Neurol Neurosurgery Psychiatry 2006;77:830–833
3. Montalban X, et al. Neurology 2010;74:427–434

These diagnostic criteria were developed by the International Panel on the Diagnosis of MS. See cited articles for details. Funding through National Multiple Sclerosis Society (USA), European Committee for Treatment and Research in MS; additional support from the Multiple Sclerosis International Federation and MS Ireland.

NO. 4

Basic Neurological Examination

It is very important to gather as much information as possible to complete a comprehensive clinical assessment. New patients in the office or hospital merit a comprehensive health history. However, in many situations, a more flexible, focused, or problem-oriented interview may be appropriate.

The following is an outline of what to include when taking a patient history and performing the physical exam. It should be viewed not as a rigid structure but a general guideline. Once a diagnosis is made, additional neurologic testing specific for a diagnosis of MS may be used to document disability.

SPECIFIC AREAS TO BE TESTED

- Mental Status
- Cranial Nerves
- Motor Function
- Sensory Function
- Reflex Function
- Gait/Coordination

MENTAL STATUS

Perform the mental status examination throughout the patient interaction. Interview a family member or friend if you have any concerns about the patient's responses.

- Level of alertness — is the patient alert, attentive, lethargic, or unresponsive?
- Language
  - Fluency — note content, rate of speech. Is it comprehensible?
  - Comprehension — test ability to follow simple and/or more complex commands.
  - Repetition — ask the patient to repeat phrases or sentences.
  - Naming — test ability to name items (e.g. paper, pencil).
  - Reading — test ability to follow a written command.
  - Writing — test ability to write an original sentence and to write a sentence from dictation.

- Memory
  - Recent — orientation to time, place, person.
  - Remote — e.g. birthdays, anniversaries, names and ages of children
  - Recall — ask the patient to memorize three unrelated words (e.g. baseball, horse, purple), distract him/her for 5 minutes (usually by performing other parts of the examination), then ask the patient to recall the list.
- Calculation — ask some straightforward computation problems (5+8-3); word problems (e.g., "How many quarters in $3.75?").
- Construction — ask the patient to draw a clock, including all the numbers, and to place the hands at 4:10. Ask the patient to draw a cube; for patients who have trouble doing so, draw a cube and ask them to copy it.
- Abstraction — Ask the patient to explain similarities ("What do an apple and an orange have in common?"; "... a bicycle and an airplane?") and differences ("What's the difference between a radio and a television?"; "... a river and a lake?")

Many patients resist formal mental status testing. It can be omitted unless there is a specific need or, when necessary, defer formal testing until the rest of the examination is done.

Some examiners would approximate the level of performance of a patient and then ask a screening question that he/she thinks may be a little too tough. If the patient gets the correct answer, the easier questions can be skipped. If the patient doesn't get the correct answer, one can gradually reduce the difficulty of the questions until a right level of performance is reached.

When reporting the mental status examination, certain findings can only be interpreted by knowing a patient's ability to perform other more fundamental tasks. As an example, difficulty with simple calculations may have some localizing significance in a patient who is otherwise cognitively intact, but not in a patient who is unable to answer any questions because of impaired language function or a depressed level of consciousness. This ambiguity is avoided by reporting the level of alertness first, then language function, and then memory. When reporting the results of mental status testing, it is most informative to convey patients' actual responses, rather than interpretations such as "mildly normal" or "slightly concrete."

When interpreting performance on mental status testing, keep in mind that patient background will influence performance. There is no reliable way to correct for this. Some tests are affected more than others. The ability to copy a sequence of repetitive hand movements is relatively independent of education. In contrast, interpretation of proverbs is dependent upon cultural and educational background. All of the categories used to describe mental status are convenient simplifications, but they do not necessarily reflect the way in which the brain functions.

CRANIAL NERVES

See Table 4.

TABLE 4: CRANIAL NERVES

CRANIAL NERVE	PROCEDURE
CN I (Olfactory)	Test ability to identify familiar aromatic odors, one naris at a time with eyes closed. *Do not use pungent stimulant.*
CN II (Optic)	Acuity — ask patient to read the lowest possible line on the Snellen's chart or E chart. Obtain best corrected acuity (e.g. with glasses or pinhole). Visual field — use a 3–4mm red stimulus. Funduscopic examination — examine optic disc using an ophthalmoscope. Inspect the clarity of the disc outline, and observe for the presence or absence of venous pulsations. The background of the fundus is either yellow or pink, depending on race. Observe the color of the disc (e.g. salmon, pink, pale). *Each eye must be tested separately.*
CN III (Oculomotor), CN IV (Trochlear), CN VI (Abducens)	Observe the patient's eyelids for ptosis. Inspect pupil's size for equality and their direct and consensual response to light and accommodation. Test extraocular movement. Observe for nystagmus (involuntary back-and-forth or cyclical movements of the eyes). Ask the patient to avoid any movement of the head but to continue watching your finger as you slowly move it to the patient's right and left side, upward, downward.
CN V (Trigeminal)	Palpate jaw muscles for tone and strength when patient clenches teeth. Have patient open mouth to see if jaw deviates from midline. Lightly touch the patient's right forehead once, and then repeat on the opposite side. Ask the patient if the two stimuli felt the same. Repeat this procedure on the cheek and on the chin. In some circumstances, the testing should be repeated applying light pressure with a sterile pin. Corneal reflex is tested by having the patient look to the far left, then touching the patient's right cornea with a fine wisp of cotton (introduced from the patient's right, outside the field of vision) and observing the reflexive blink that occurs in each eye.

CRANIAL NERVE	PROCEDURE
CN VII (Facial)	Inspect face for muscle atrophy and tremor. Have the patient close his or her eyes tightly. Observe whether the lashes are buried equally on the two sides and whether you can open either eye manually. Have the patient look up and wrinkle the forehead; note for symmetry. Have the patient smile, and observe whether one side of the face is activated more quickly or more completely than the other. Observe for flattening of the naso-labial fold. Check the palpebral fissures for symmetry (wider on side of facial weakness). Test ability to identify sweet and salty tastes on each side of tongue. Taste should be tested with tongue held outside of the mouth. *Certain areas on the tongue are more receptive to specific flavors: tip (sweet), sides (salt, sour), back (bitter).*
CN VIII (Acoustic)	For a bedside examination, it usually suffices to perform a quick hearing assessment by holding your fingers a few inches away from the patient's ear and rubbing them together softly. *Weber test — place base of vibrating tuning fork on midline vertex of head to test for lateralization.* *Rinne test — place base of vibrating tuning fork against mastoid bone to compare air and bone conduction.*
CN IX (Glossopharyngeal)	Test gag reflex and ability to swallow. Test ability to identify sour and bitter tastes.
CN X (Vagus)	Touch posterior wall of pharynx with tongue depressor while observing palate, pharyngeal muscles, uvula. Ask patient to say "ahh". Observe the palate and uvula — do they rise in midline? Note for any curtain sign (uvula moves toward the normal side). Observe for swallowing difficulty.

CRANIAL NERVE	PROCEDURE
CN XI (Spinal Accessory)	Have the patient turn the head all the way to the left. Place your hand on the left side of the chin and ask the patient to resist you as you try turning the head back to the right. Palpate the right sternocleidomastoid muscle with your other hand at the same time. Repeat this maneuver in the other direction to test the left sternocleidomastoid. To test shoulder elevation, ask the patient to shrug the shoulders while you resist the movement with your hands.
CN XII (Hypoglossal)	Inspect tongue for fasciculation/involuntary contraction or twitching. *Deviations are toward affected side.* Inspect tongue movement toward nose and chin. Test tongue strength with index finger when tongue is pressed against cheek. Evaluate quality of lingual speech sounds (l, t, d, n).

MOTOR FUNCTION

- Assess muscle bulk, inspect muscle contours, and note any atrophy. Note any spasticity, rigidity, flaccidity.

  Tone is qualitatively assessed by asking the patient to relax and let you manipulate the limbs passively. It is sometimes difficult to perform this on some patients. They may be distracted by engaging them in unrelated conversation or ask them to let their limbs go limp.
- Assess for involuntary movements (e.g. clonus, myoclonic jerks). Observe location, quality, rate, rhythm.
- Strength testing *(see Table 5)* — In the upper extremities, test shoulder abduction, elbow extension, elbow flexion, wrist extension, wrist flexion, finger extension, finger flexion, and finger abduction. In the lower extremities, test hip flexion, hip extension, knee flexion, knee extension, ankle dorsiflexion, and ankle plantar flexion. If some of these muscles are weak or if the patient complains of focal weakness, additional testing may be necessary to determine if the weakness is in the distribution of a specific nerve or nerve root.

For each movement, place the limb near the middle of its range, and then ask the patient to resist you as you try to move the limb from that position. As an example, in testing shoulder abduction, the patient's arms should be horizontal, forming a letter T with the body, and the patient should try to maintain that position while you press down on both arms at a point between the shoulders and the elbows. When possible, place one hand above the joint being examined to stabilize the joint, and exert pressure with your other hand just below the joint, to isolate the specific movement you are trying to test.

Look for a pattern in any detectable weakness. It may suggest a lower motor neuron lesion affecting a peripheral nerve or nerve root. Weakness of one side of body suggests an upper motor neuron lesion. A polyneuropathy causes symmetric distal weakness, and a myopathy usually causes proximal weakness.

Monoparesis refers to weakness of a single limb. Hemiparesis is weakness of one side of the body. Paraparesis is weakness of both lower extremities. Quadriparesis is weakness of all four limbs. Monoplegia, hemiplegia, paraplegia, and quadriplegia are analogous terms that refer to complete or nearly complete paralysis of the involved limbs.

TABLE 5: GRADING MUSCLE STRENGTH

GRADE	DESCRIPTION
0	No muscular contraction detected
1	A detectable contraction
2	Active movement with gravity eliminated
3	Active movement against gravity
4	Active movement against gravity and some resistance
5	Active movement against full resistance.

Add "-" or "+" to indicate the finding (e.g. "3-" may indicate muscle strength moving poorly against gravity, "3+" indicate muscle strength moves well against gravity.

- Finger-to-nose testing — Ask the patient to use the tip of his or her right index finger to touch the tip of your index finger, then the tip of his or her nose, then your finger again, and so forth. Hold your finger so that it is near the extreme of the patient's reach, and move it to several different positions during the testing. Repeat the test using the patient's left arm. Observe for accuracy and tremor.
- Heel-to-shin testing — Have the patient lie supine, place the right heel on the left knee, and then move the heel down the shin to the ankle. Repeat using the left heel on the right shin. Again, observe for accuracy and tremor.

- Pronator drift — Have the patient stretch out the arms so that they are level and fully extended with the palms facing straight up, and then close the eyes. Watch for 5 to 10 seconds to see if either arm tends to pronate (so that the palm turns inward) and drift downward.
- Rapid alternating movements — Have the patient alternately pronate and supinate the right hand against a stable surface (e.g. a table, the patient's own thigh or left hand) as rapidly as possible; repeat for the left hand. Observe speed, accuracy, and rhythm. Impaired ability to perform this task is referred to as dysdiadochokinesis. There is clumsiness and irregular movements in cerebellar disease. Also, have patient tap middle finger on distal interphalangeal joint. Loss of speed and dexterity reflects upper motor neuron dysfunction.

SENSORY

This involves testing first the primary sensory modalities (e.g. light touch, pain and temperature, vibration, joint position sense) and then the discriminative sensory functions (e.g. stereosognosis, graphesthesia, point localization, two point discrimination, and extinction). The former test the integrity of the afferent sensory pathways, whereas the latter test the ability of sensory and association cortices to analyze and interpret sensory input.

Ask patient to close eyes before sensory testing begins. Use minimal stimulation initially, and then increase gradually until patient becomes aware. Test contralateral areas, asking patient to compare perceived sensations side to side.

- Superficial touch — lightly touch skin with cotton wisp or your fingertips.
- Superficial pain — alternating sharp and smooth edge of broken tongue blade or point and hub of sterile needle, touch skin in unpredictable pattern. Ask patient to identify sensation (sharp or dull) and where it is felt.
- Temperature — alternately roll test tubes of hot or cold water against skin in an unpredictable pattern (a tuning fork can also serve for cold stimulation). Ask patient to indicate hot or cold and where it is felt.
- Vibration — place stem of vibrating tuning fork (e.g. 128-Hz) against several bony prominences (e.g. toes). Ask patient if they feel the vibration and when it stops.
- Joint position sense — hold joint to be tested (great toe or finger) by lateral aspects in neutral position, then raise or lower digit, and ask patient which way it is moved. Return to neutral position before moving in another direction. Repeat at both feet.
- Stereosognosis — hand patient familiar objects (e.g. key, coin) and ask patient to identify.
- Extinction phenomenon — simultaneously touch cheek, hand, or other area on each side of the body and ask patient the number of stimuli and locations.
- Graphesthesia — with blunt pen or applicator stick, draw letter or number on palm of patient's hand, and ask patient to identify it. Repeat with different figure on other hand.
- Two-point discrimination (to test cortical sensory functions) — using 2 stimuli, alternately touch patient's skin with one or both points simultaneously at various locations. Find distance at which patient can no longer distinguish 2 points.

REFLEXES *(SEE TABLE 6)*

- Tendon reflexes — The biceps, triceps, brachioradialis, knee (patellar), and ankle (Achilles) reflexes are the ones commonly tested. The joint under consideration should be at about 90 degrees and fully relaxed. It is often helpful to cradle the joint in your own arm to support it. With your other arm, hold the end of the hammer and let the head of the hammer drop like a pendulum so that it strikes the tendon:
  - Biceps (C5, C6) — just anterior to the elbow.
  - Triceps (C6, C7) — just posterior to the elbow.
  - Brachioradialis (C5, C6) — about a few centimeters above the wrist on the radial aspect of the forearm.
  - Knee (L2, L3, L4) — just below the patella.
  - Ankle (S1) — just behind the ankle.

Relaxation is critical during the reflex examination. Tendon reflexes are difficult to elicit when patients tense the muscles being tested. It is helpful to distract patients by engaging them in conversation while testing their reflexes and to put a slight tension on the muscle being tested.

When a patient has reflexes that are difficult to elicit, you can amplify them by using reinforcement procedures: Ask the patient to clench his or her teeth or (when testing lower extremity reflexes) to hook together the flexed fingers of both hands and pull. This is also known as the Jendrassik maneuver.

Clonus is a rhythmic series of muscle contractions induced by stretching the tendon. It most commonly occurs at the ankle, where it is typically elicited by suddenly dorsiflexing the patient's foot and maintaining light upward pressure on sole.

When reflexes are brisk, it is difficult to detect slight asymmetry. For the most sensitive comparison, it is best to reduce the stimulus until it is just barely above threshold for eliciting the reflex.

Such subtle distinctions are most readily made by testing the reflex on one side immediately after testing the corresponding reflex on the other side, rather than testing all reflexes in one limb before testing the contralateral limb.

Another technique to heighten sensitivity to subtle reflex asymmetry is to place a finger on the patient's tendon and strike the finger rather than striking the tendon directly. This allows one to feel the tendon contraction.

- Plantar response (L5, S1) — Using a blunt, narrow surface (e.g., broken tongue blade, a wooden Q tip, key), stroke the sole of the patient's foot on the lateral edge, starting near the heel and proceeding along the lateral edge almost to the base of the little toe, then curve the path medially just proximal to the base of the other toes. This should take the form of a smooth "J" stroke. The normal response is for all the toes to flex (a "flexor plantar response"). When there is damage to the central nervous system motor pathways, an abnormal reflex occurs: the great toe extends (dorsiflexes) and the other toes may fan out. This is called an extensor plantar response; it is also known as a Babinski sign.

Comparison between reflexes in one part of the body and another is much more important than the absolute reflex grade. The most important comparison is between corresponding reflexes on the right and left, where even subtle asymmetry may be significant.

TABLE 6: GRADING REFLEXES

GRADE	DESCRIPTION
4+	Clonus
3+	Increased (hyperactive)
2+	Normal
1+	Reduced (hypoactive)
0	Absent

GAIT/COORDINATION

- Observe the patient's casual gait, preferably with the patient unaware of being observed. Have the patient walk away, turn, and come back, walk on toes, then on heels, walk heel-to-toe (tandem) as if walking on a tightrope, hop in place on each foot. Note if the patient is unsteady with any of these maneuvers or if there is any asymmetry. Also note for scissoring or circumduction or foot drop. Upper or lower motor neuron weakness, cerebellar ataxia, parkinsonism, and loss of position sense may all affect performance. Note the arm swing for symmetry. Note the base — is it too wide (cerebellar dysfunction) or too narrow (parkinsonism).
- Romberg test (a sensory test of stance) — Ask patient to stand with feet together and eyes open, then closed for 20–30 seconds. Mild sway may occur. (Stand close by to prevent falls). Loss of balance that appears only when eyes are closed is a positive Romberg test, suggesting poor position sense.
- Timed 25 foot walk (T25FW) — a quantitative mobility and leg function performance test based on time. It is also a component of the Multiple Sclerosis Functional Composite (MSFC). The patient is directed to one end of a clearly marked 25-foot course and is instructed to walk 25 feet as quickly as possible, but safely. The time is calculated from the initiation of the instruction to start and ends when the patient has reached the 25-foot mark. The task can be immediately administered again by having the patient walk back the same distance. Patients may use assistive devices when doing this task.

STANDARD SCALES FOR DISABILITY IN MS

Neurological impairment and disability, both at diagnosis and over the course of the disease, can be quantified by the Kurtzke Expanded Disability Status Scale (EDSS). This is a standard scale (0 =normal and 10=death due to MS) used to rate the degree of MS related neurological disability. However this scale is heavily weighted toward ambulation and may not provide a true picture of the patient's functional status. It takes significant time to complete and therefore is primarily used during research studies. Another measure that is used to evaluate disability is the Multiple Sclerosis Functional Composite (MSFC), which consists of the Paced Auditory Serial Addition Test (PASAT), 9 Hole Peg Test, and the T25FW. These scores can be compared individually over time. Though developed for research purposes, items within the MSFC may be useful to document a patient's condition.

NO. 5

Symptomatology

Given the varied nature and distribution of pathologic lesions in MS, it is expected that the disease will cause a variety of clinical deficits or combination of deficits. To manage MS effectively, the disease process should be modified to the extent possible; symptoms of the disease should be managed to allow better function and safety; and the person with the disease should be given the psychosocial support needed to improve his or her quality of life.

SYMPTOMS IN MS MAY BE DIVIDED INTO THE FOLLOWING:

- Primary symptoms — those that are caused directly by demyelination within the brain and spinal cord (e.g. weakness, gait disturbance, visual loss, bowel/bladder dysfunction).
- Secondary symptoms — those that are indirectly caused by the disease (e.g., skin breakdown caused by immobility).
- Tertiary symptoms — those related to the psychosocial impact of the disease (e.g. emotional, vocational or marital problems).
- Neurological impairment leads to disability — difficulty with activities of daily living, and handicap — impacting one's position in the community and at work.

FATIGUE

Fatigue is the most common symptom of MS (reported by 80–90% of patients) — and one of the primary reasons why people with MS leave the workforce. Several types of fatigue can occur, including:

- Fatigue caused by sleep disturbances, which can be primary or secondary to other MS symptoms such as bladder problems, spasticity, or pain.
- A "short-circuiting" type of fatigue that results from demyelination in the nerves going to the upper and lower extremities. People with this type of fatigue experience increased weakness during prolonged activity, which resolves with rest.
- Fatigue resulting from depression.
- Fatigue or sleepiness that occurs as a side effect of medications.
- Cognitive fatigue that occurs during tasks requiring sustained attention, even in the absence of physical fatigue.
- MS fatigue — or "lassitude" — which is unique to this disease. It is an abrupt, often overwhelming tiredness that can come on at any time, regardless of time of day or amount of sleep or rest. Lassitude, which can be worsened by heat and humidity, is subjectively described as a lack of physical and/or mental energy that is perceived by the individual of caretaker to interfere with usual or desired activities.
- Management — The management of fatigue includes exercise, energy management strategies, energy conserving devices such as mobility aids and other tools, cooling strategies, and prompt attention to the other contributing factors listed above. MS lassitude responds well to certain types of medication. *(See "Pharmacotherapeutics").*

VISUAL DISTURBANCES

The optic nerve, which is an out-pocketing of the brain, is highly myelinated and thus very prone to demyelination and inflammation. This can result in an acute overall loss of vision.

- Optic Neuritis — subacute loss or disturbance in vision and possibly pain behind affected eye, caused by inflammation or demyelination of optic nerve, most often temporary, with complete or partial recovery.
- Management — Optic Neuritis typically resolves spontaneously. Corticosteroids may be prescribed if a patient's vision is too impaired or if pain is too severe.

- Marcus-Gunn Pupil (also called APD — Afferent Pupillary Defect) — pupillary dilation is paradoxically seen when a light is moved from the unaffected to the affected side.
- Nystagmus — rhythmic jerkiness or bounce in one or both eyes.
- Diplopia — double vision, or the simultaneous awareness of two images of the same object that results from a failure of the two eyes to work in a coordinated fashion. Covering one eye will erase one of the images.
- Oscillopsia — a visual disturbance in which objects appear to be jumping or bouncing.
- Uthoff's phenomenon — an unusual symptom characterized by decrease in vision associated with exercise, probably due to an increase in body heat, which affects nerve conduction. Vision returns when the person stops exercising and cools down.

MOTOR SYMPTOMS

Involvement of the pyramidal tracts, either in the spinal cord or higher in the CNS, produces weakness typical of an upper motor neuron lesion.

- Spasticity — an increase in muscle tone that can interfere with normal movement of the affected limb, caused by dysregulation of nerve impulses in the spinal cord.
  - Management:
    - Rehabilitation with physical therapist and/or occupational therapist.
    - Balance, stretching and coordination exercises.
    - Medication management. (*See Chapter 7*).
- Contractures — abnormal, sometimes permanent flexion/limitation (bending) of a joint that can occur if range of motion is limited by spasticity, weakness or lack of use of a limb.
  - Management:
    - Rehabilitative Physical and/or Occupational Therapy Program (stretching and range of motion exercises)
    - Medications:
      - Oral Medications: *(e.g. Baclofen. See "Pharmacotherapeutics")*.
      - Intrathecal Baclofen Pump (ITB) type A or B.
      - Botulinum Toxin Type A or B injections — disrupts activity at the neuromuscular junction.
      - Intrathecal Phenol — causes denervation of sensory and motor nerve fibers in surrounding areas (Phenol nerve block).
- Foot drop — plantar flexion of the foot as seen with weakness of the dorsiflexor of the foot.
  - Management:
    - Orthotics — use of ankle-foot orthosis (AFO) for foot drop, or functional electrical stimulation (FES) device such as Walk Aide and NESS L300.

- Dysmetria — a disturbance of coordination, caused by lesions in the cerebellum. A tendency to over- or underestimate the extent of motion needed to place an arm or leg in a certain position as, for example, in overreaching for an object.
- Dysphonia — disorders of voice quality (including poor pitch control, hoarseness, breathiness, and hypernasality) caused by spasticity, weakness, and discoordination of muscles in the mouth and throat.
- Dysarthria — poorly articulated speech resulting from dysfunction of the muscles controlling speech, usually caused by damage to the central or peripheral nervous system. The content and meaning of the spoken words remain normal.
- Hyperreflexia — increased action of the reflexes.
- Myoclonus — rapid, shock-like muscle jerks that move a joint, may involve limbs or trunk.

SENSORY SYMPTOMS

- L'hermitte's sign — abnormal "electrical" sensation down the back or limbs, elicited by flexing of the neck, bringing the head forward.
- Dysesthesia — burning sensation caused by abnormalities in the sensory pathways in the brain and spinal cord.
- Numbness/Tingling — occurs when the nerves that transmit sensation do not conduct information properly, so that one is unable to fully appreciate sensations from that area.
- Cold feet — results from short-circuiting in the autonomic nervous system interconnections that control the diameter of blood vessels. This does not signify a significant circulatory problem.

BRAINSTEM SYMPTOMS

- Internuclear Ophthalmoplegia (INO) — disconjugate abnormalities of eye movement. Adducting eye may not cross the midline, abducting eye shows nystagmus.
- Tic Douloureux/Trigeminal Neuralgia — a stabbing or shock-like pain at the face, often moving centrifugally away from the snout area which can be aggravated by wind, chewing, talking, or brushing teeth.
- Management:
  - Medication Management (e.g. Tegretol, Neurontin. *See "Pharmacotherapeutics"*).
  - Surgical
    - Rhizotomy — surgical resection of a nerve root to relieve pain or reduce spasticity.
- Spinning, Dizziness and Vertigo — sensation of "spinning", which, when severe, may be accompanied by nausea and vomiting, resulting from an irritation of the brain stem structures that help to maintain balance.
- Facial myokymia/Hemifacial spasms — twitching of isolated segments of muscle.

CEREBELLAR INVOLVEMENT

- Tremor — involuntary, relatively rhythmic movement of the arms, legs, head or trunk.
- Intention tremor — a relatively slow, oscillating (back and forth) movement of a limb engaged in purposeful movement, often with pre-terminal enhancement.
- Titubation — a form of tremor, resulting from demyelination in the cerebellum that manifests itself primarily in the head, neck and trunk, with involuntary head movement.
- Ataxia — inability to perform coordinated muscle movements.
- Management — Management of cerebellar symptoms is primarily rehabilitative. Medication may be useful for tremor in some individuals.

BLADDER DYSFUNCTION

For normal urination to occur, the detrusor or bladder muscle must contract to expel urine at the same time that the internal and external sphincters are relaxed to allow the urine to pass freely out of the body. Urinary incontinence related to neurogenic bladder dysfunction is caused by one of two problems:

- Failure to store — caused by detrusor hyperreflexia resulting in urgency, urinary frequency, urge incontinence.
- Failure to empty — caused by acontractile bladder and detrusor areflexia, hyporeflexia with poorly sustained contractions resulting to urinary retention, urinary tract infection and overflow incontinence.
- Detrusor-external sphincter dyssynergia (DESD) — lack of coordination between muscle groups resulting in urgency, frequency, urge incontinence, urinary retention, urinary tract infection, dysuria and/or decreased flow. Bladder contraction may occur with a tightly closed sphincter.
- Management — Management includes the following strategies, depending on the type of dysfunction:
  - Behavioral Therapy — timed voiding, dietary modification, avoiding caffeinated beverages
  - Intermittent Catheterization
  - Medication Management (e.g. Anticholinergics, Alpha Blockers, botulinum toxin. *See Chapter 7*).
  - Surgical
    - Suprapubic Tube/Cathether — indwelling catheter placed directly into the bladder through the abdomen, above the pubic bone. Can be temporary or permanent.
    - Cystoplasty — enlargement of bladder to increase capacity and to lower bladder pressure. May provide opening to abdomen for ease of intermittent catheterization.
    - Urostomy-opening in the abdominal wall through which urine leaves the body into a collection device, bypassing the bladder.
    - Sphincterotomy (permanent) or Stent placement (potentially reversible) — procedure used in males with detrusor external sphincter dyssynergia (combined storage and emptying dysfunction).

BOWEL DYSFUNCTION

- Constipation — infrequent or difficult elimination of stool; less than two bowel movements per week.
  - Management:
    - Dietary Modification — increase amount of fiber in diet, increase fluid intake.
    - Establishing a bowel program (e.g. regular defecation on schedule).
    - Use of fiber supplements.
    - Medications — stool softeners, laxatives, enemas, suppositories *(See Chapter 7).*
- Incontinence — uninhibited bowel elimination can result due to loss of or diminished sphincter control or hyperreflexic bowel. Managing bowel symptoms is often the result of trial and error. A structured daily plan for bowel management can lead to more predictable bowel habits.
- It is important to remember that the goal of any bowel management program is for a patient to move his or her bowels comfortably in an appropriate setting and at a minimum of 2–3 times per week. It can take months to be successful in developing a regular bowel pattern.

SEXUAL DYSFUNCTION

A chronic illness such as MS may have tremendous impact on sexuality. Sexual dysfunction in MS may include decreased or absent sexual drive, decreased blood flow and muscle tone, impaired sensation, erectile dysfunction or ejaculatory problems or difficulty achieving orgasm. Symptoms such as spasticity, bowel and bladder problems, pain, cognition issues, psychological issues and fatigue can contribute to sexual problems.

Communication is critical to achieving a positive, enjoyable sexual relationship. Management strategies include exploring alternative pleasurable activities and areas of sensation on the body; i.e. lubricants, sexual aids such as vibrators or other sex toys, medication to treat erectile dysfunction like Viagra and Levitra. *(See Chapter 7, Table 9)*.

DEPRESSION/EMOTIONAL ISSUES

- Depression — More than 50% of MS patients will experience a major depressive episode some time during the course of their disease. Suicide is seven times as common in MS than in general population.
  - Management:
    - Psychosocial interventions by psychologist, psychiatrist, or social worker
    - Medication Management (e.g. antidepressant agents — TCA, SSRI. *See Chapter 7*).
- Pseudobulbar affect (PBA) — uncontrolled episodes of laughing or crying that are unrelated to mood or circumstances. PBA is direct result of demyelination in the brain, probably in the limbic system, and can be treated with Nuedexta (dextromethorphan and quinidine) — a drug approved for this use in 2010.

COGNITIVE IMPAIRMENT/HIGHER CORTICAL FUNCTION

Cognitive impairment may be one of the most feared symptoms of MS. It can change the personality and, in the extreme, lead to total functional dependence. Approximately 50–60% of people experience some degree of impairment.

- Short-term memory dysfunction, slowed information processing, executive dysfunction with difficulty planning and prioritizing, multi-tasking and organizing, and impaired judgement, problems with usual-spatial skills.

The Multiple Sclerosis Neuropsychological Screening Questionnaire (MSNQ) is a simple tool that can be used in the clinical setting as a preliminary screen for cognitive impairment. Once a cognitive deficit is identified, the nurse can assess the patient's daily routine and design strategies to help the patient and family cope with the disability. For those patients with mild impairment, simple strategies such as reminder notebooks and detailed lists of tasks to be performed may address the problem sufficiently. Those with more advanced decline may require referral for formal cognitive training by a neuropsychologist, occupational therapist, or speech and language pathologist.

NO. 6

Pharmacotherapeutics

As a primary source of information for patients and families affected by MS, nurses are in an optimal position to provide education about medications. Nurses can provide practical information about indications, effectiveness, and side effects, thereby facilitating patients' treatment decisions, clarifying any misconceptions, and ensuring proper use of medications.

There is no drug that can cure MS, but treatments are now available that can treat exacerbations, manage symptoms, and modify the course of the disease.

MEDICATIONS FOR MS INCLUDE

Management of acute MS exacerbations

- Methylprednisolone (IV); Prednisone, Medrol, Decadron (PO), adrenocorticotropic hormone (ACTH), Acthar Gel (IM)

Symptomatic treatments

Those used to minimize or control specific symptoms such as spasticity, bowel and bladder problems and fatigue. *(See Chapter 10 — Medication List).*

Disease-modifying treatments

Several medications are now FDA-approved for the treatment of multiple sclerosis. Each has been found to reduce the frequency of relapses and lesion activity on MRI. Some have also demonstrated the ability to slow disease progression and/or reduce the accumulation of disability.

- interferon beta 1a
  - Avonex
  - Rebif
- interferon beta 1b
  - Betaseron
  - Extavia
- glatiramer acetate
  - Copaxone
- mitoxantrone
  - Novantrone
- natalizumab
  - Tysabri
- fingolimod
  - Gilenya

Other medications being studied

- Oral therapies
  - BG-12 (dimethylfumarate)
  - laquinimod
  - teriflunomide
- Monoclonal antibodies
  - alemtuzumab
  - rituximab
  - ocrelizumab
  - daclizumab

TABLE 7A: SIDE-BY-SIDE VIEW OF FIRST-LINE DISEASE-MODIFYING MEDICATIONS

FIRST-LINE OPTIONS TO TREAT RELAPSING FORMS OF MS				
Generic Name and Brand Name				
Interferon beta-1b Betaseron Extavia	Interferon beta-1a Avonex	Interferon beta-1a Rebif	Glatiramer acetate Copaxone	Fingolimod Gilenya
Manufacturer/Distributor				
Bayer Healthcare Pharmaceuticals Inc. Novartis Pharmaceuticals	Biogen Idec	EMD Serono, Inc./Pfizer, Inc.	Teva Neuroscience	Novartis Pharmaceuticals
Approval				
Betaseron — 1993 US 1995 Canada — RRMS 1999 Canada — SPMS Extavia —2009	1996 US 1998 Canada	1998 Canada 2002 US	1996 US 1997 Canada	2010 US
Frequency/Route of Delivery				
Every other day; subcutaneous injection. Autoinjector.	Weekly intramuscular injection. No autoinjector.	Three times per week; subcutaneous injection. Autoinjector.	Daily, subcutaneous injection. Autoinjector.	Every day; capsule taken orally.

Generic Name and Brand Name				
Interferon beta-1b Betaseron Extavia	Interferon beta-1a Avonex	Interferon beta-1a Rebif	Glatiramer acetate Copaxone	Fingolimod Gilenya
Usual Dose				
250 mcg	30 mcg	44 mcg	20 mg (20,000 mcg)	0.5 mg
Common Side Effects				
Flu-like symptoms following injection, which lessen over time for many people; injection site reactions, about 5% of which need medical attention. Less common: Depression, elevated liver enzymes, low white blood cell counts.	Flu-like symptoms following injection, which lessen over time for many people. Less common: Depression, mild anemia, elevated liver enzymes, liver toxicity.	Flu-like symptoms following injection, which lessen over time for many people; injection site reactions. Less common: Depression, elevated liver enzymes, low white blood cell counts.	Injection site reactions. Less common: A reaction immediately after injection which includes anxiety, chest tightness, shortness of breath, and flushing. This lasts 5–10 minutes and has no known long-term effects.	Headache, flu, diarrhea, back pain, liver enzyme elevations and cough. Less common: Slowed heart rate following first dose, infections, and macular edema.
Patient Information and Financial Support Programs				
Betaplus 1-800-788-1467 *betaseron.com*	MS Active Source 1-800-456-2255 *avonex.com* *msactivesource.com*	MS LifeLines 1-877-44-REBIF (1-877-447-3243) *rebif.com* *mslifelines.com*	Shared Solutions 1-800-877-8100 *copaxone.com* *sharedsolutions.com* *mswatch.com*	Patient Support Program 1-877-408-4974

Not everyone will experience every one of these side effects. Some adverse effects are common, and others are very infrequent but may be serious. Periodic liver function testing is recommended for all individuals taking an interferon medication.

TABLE 7B: SIDE-BY-SIDE VIEW OF ADDITIONAL DISEASE-MODIFYING MEDICATIONS

ADDITIONAL APPROVED TREATMENT OPTIONS	
Generic Name and Brand Name	
Natalizumab Tysabri	Mitoxantrone Novantrone
Manufacturer/Distributor	
Biogen Idec and Elan Pharmaceuticals	Serono, Inc.
Approval	
2006 US 2006 Canada	2000
Frequency/Route of Delivery	
IV infusion every four weeks in a registered infusion facility.	Four times a year by IV infusion in a medical facility. Lifetime cumulative dose limit of approximately 8–12 doses over 2–3 years.
Usual Dose	
300 mg	12 mg/m2
Common Side Effects	
Headache, fatigue, urinary tract infections, depression, lower respiratory tract infections, joint pain, and chest discomfort. Less common: allergic or hypersensitivity reactions within two hours of infusion (dizziness, fever, rash, itching, nausea, flushing, low blood pressure, difficulty breathing, chest pain. *See Patient Information websites below for more information on side effects and risks associated with progressive multifocal leukoencephalopathy (PML).*	Blue-green urine 24 hours after administration; infections, bone marrow suppression (fatigue, bruising, low blood cell counts), nausea, hair thinning, bladder infections, mouth sores. Patients must be monitored for serious liver and heart damage. *See Patient Information website below for more information on side effects and risks.*
Patient Information and Financial Support Programs	
1-800-456-2255 *tysabri.com* *biogenidec.com*	1-877-447-3243 *novantrone.com*

Note

- The following medication information should never be used as a substitute for a physician's instructions and recommendations.
- Inform physician of all medications the patient is currently taking — including both prescription and over-the-counter medications, nutritional supplements and herbs.
- Inform physician of the patient's medical history, including all medical conditions. Note any allergies. Note any use of alcohol.
- Always notify physician if patient is breast-feeding, currently pregnant or planning to become pregnant in the future.
- Administer the medication only as prescribed.
- Follow proper procedure of storing medications.
- For missed doses, follow your hospital or facility protocol, otherwise, refer to physician.

(Since it may be difficult to distinguish between certain common symptoms of MS and some side effects of any of the following drugs, be sure to refer to physician if an abrupt change of this type continues for more than a few days).

TABLE 8: DISEASE-MODIFYING THERAPIES WITH NURSING CONSIDERATIONS

AVONEX (INTERFERON BETA 1A)

Description	Nursing Consideration
Manufactured by a biotechnological process from one of the naturally-occurring interferons (a type of protein). It is made up of exactly the same amino acids (major components of proteins) as the interferon beta found in the human body. Indication Approved by U.S. FDA for relapsing forms of MS to slow the accumulation of physical disability and decrease the frequency of clinical exacerbations. Patients with MS in whom efficacy has been demonstrated include those who have experienced a first clinical episode and have MRI features consistent with MS. Dose 30 mcg Frequency Once weekly Route Intramuscular (IM) injection, usually in the large muscles of the thigh, upper arm, or hip. *Note: Intended for use under guidance and supervision of a physician. Patients may self-inject only if their physician determines that it is appropriate and with medical follow-up, as necessary, after proper training in intramuscular injection technique which can be facilitated by a nurse.*	Available in 2 forms ■ Powder form — single-use vial, requires reconstitution. Vials should be stored in the refrigerator, although storage at room temperature is permissible for up to 30 days. Once the medication has been mixed for use, it is recommended that it be administered as soon as possible — or within 6 hours if stored in the refrigerator. ■ A liquid form in a pre-filled syringe. Pre-filled syringes should be stored in the refrigerator, and allowed to come to room temperature (about 20 minutes) prior to injecting. Once removed from the refrigerator, the pre-filled syringe should be used within 12 hours. Recommended to be given at bedtime since flu-like symptoms are a fairly common side effect. Taking acetaminophen (Tylenol) immediately prior to each injection and during the 24 hours following the injection will also help to relieve the flu-like symptoms. However, if sleep is impacted, injection may be taken earlier in the day. Prior to taking Avonex, ask patient about any of the following medical problems: depression, anxiety, any trouble sleeping; problems with thyroid gland; anemia, low white cell count, bleeding/bruising easily; seizures, cardiac problems, liver disease. Periodic blood tests are recommended because of the potential of Avonex to affect the functioning of the liver (elevated LFT) and thyroid gland, and to cause a drop in the levels of white blood cells, red blood cells, and platelets.

Avonex Support Program

Avonex ActiveSource℠

1-800-456-2255

www.avonex.com

www.MSActiveSource.com

Possible Side Effects*

Common side effects include flu-like symptoms (fatigue, chills, fever, muscle aches, sweating). Most of these symptoms will tend to disappear after the initial few weeks of treatment. Symptoms of depression, including ongoing sadness, anxiety, loss of interest in daily activities, irritability, low self-esteem, guilt, poor concentration, indecisiveness, confusion, and eating and sleep disturbance should be reported promptly to physician.

** Since it may be difficult to distinguish between certain common symptoms of MS and some side effects of this drug, be sure to refer to physician if an abrupt change of this type continues for more than a few days.*

BETASERON AND EXTAVIA (IDENTICAL FORMULATIONS OF INTERFERON BETA 1B)

Description

Manufactured by a biotechnological process from one of the naturally occurring interferons (a type of protein).

Indication

Approved by U.S. FDA for relapsing forms of MS to reduce the frequency of clinical exacerbations. Relapsing forms of MS include individuals with secondary-progressive MS who continue to experience relapses or acute attacks.

Dose

250 mcg (0.25mg)

Suggested Schedule of Dose Titration

Week 1–2 — 0.25ml (0.0625 mg)
Week 3–4 — 0.50ml (0.125 mg)
Week 5–6 — 0.75ml (0.1875 mg)
Week 7+ — 1.0 ml (0.25mg)

Nursing Consideration

Supplied with a pre-filled diluent syringe to which the medication needs to be added prior to injection; no refrigeration is necessary. An autoinjector is available.

Recommended to be given at bedtime since flu-like symptoms are a common side effect associated with at least the initial weeks. Taking acetaminophen (Tylenol) 30 minutes before each injection will also help to relieve the flu-like symptoms. However, if sleep is impacted, injection may be taken earlier in the day.

It is recommended that the injection sites be rotated.

Injection site reactions (swelling, redness, discoloration, or pain) are relatively common. Lipoatrophy can occur with prolonged use.

Frequency

Every other day

Route

Subcutaneously (SC) injection

Note: Intended for use under guidance and supervision of a physician. Patients may self-inject only if their physician determines that it is appropriate and with medical follow-up, as necessary, after proper training in subcutaneous injection technique which can be facilitated by a nurse.

Betaseron Support Program

MS Pathways℠

1-800-788-1467

1-800-948-5777 (financial issues)

www.betaseron.com

www.MSPathways.com

Injection site necrosis which occurs in about 5% of patients during the first 4 months of therapy has been reported in post-marketing studies even after a year of treatment. Report promptly any break in the skin, which may be associated with blue-black discoloration, swelling, or drainage of fluid from the injection site.

Blood tests are recommended at regular intervals because of the potential of Betaseron to affect the functioning of the liver and thyroid gland, and to alter the levels of white blood cells, red blood cells, and platelets.

Possible Side Effects*

Depressive symptoms including sadness, anxiety, loss of interest in daily activities, irritability, low self-esteem, guilt, poor concentration, indecisiveness, confusion, and eating and sleep disturbances. Suicidal ideation should be reported to the physician.

** Since it may be difficult to distinguish between certain common symptoms of MS and some side effects of this drug, be sure to refer to physician if an abrupt change of this type continues for more than a few days.*

REBIF (INTERFERON BETA 1A)

Description

Manufactured by a biotechnological process from one of the naturally-occurring interferons (a type of protein). It is made up of exactly the same amino acids (major components of proteins) as the interferon beta found in the human body.

Nursing Consideration

Should be stored in the refrigerator. Storage at room temperature without exposure to heat or light is permissible for up to 30 days. Do not allow the medication to freeze.

An autoinjector is available. Do not reuse needles or syringes.

Indication

Approved by U.S. FDA for relapsing forms of MS to decrease the frequency of clinical exacerbations and delay the accumulation of physical disability.

Dose

Dosages shown to be safe and effective are 22mcg and 44mcg. Generally, patients should be started at 20% of the prescribed dose 3x a week and increased over a 4-week period to the targeted dose.

Suggested Schedule of Dose Titration (for Rebif 22 mcg)

Week 1–2 — 4.4 mcg
Week 3-4 — 11 mcg
Week 5+ — 22 mcg

Suggested Schedule of Dose Titration (for Rebif 44 mcg)

Week 1–2 — 8.8 mcg
Week 3–4 — 22 mcg
Week 5+ — 44 mcg

Frequency

Once weekly

Route

Subcutaneously (SC) injection

Note: Intended for use under guidance and supervision of a physician. Patients may self-inject only if their physician determines that it is appropriate and with medical follow-up, as necessary, after proper training in subcutaneous injection technique which can be facilitated by a nurse.

It is recommended that the sites be rotated. Injection site reactions and lipatrophy can occur.

Recommended to be given at bedtime since flu-like symptoms are a common side effect during the initial weeks of treatment. Taking acetaminophen (Tylenol) immediately prior to each injection and during the 24 hours following the injection will also help to relieve the flu-like symptoms. However, if sleep is impacted, injection may be taken earlier in the day.

Rebif can affect liver function. Liver function tests may be ordered to make sure the liver is working properly. Report to physician any yellowish discoloration of the sclerae, or if patient is bruising easily. Note any history of liver disease, alcoholism, or other liver problems, as well as of all the medications being taken.

Blood tests are recommended at regular intervals because of the potential of Rebif to affect the functioning of the liver and thyroid gland, and to alter the levels of white blood cells, red blood cells, and platelets.

Thyroid function tests are recommended every 6 months in patients with a history of thyroid dysfunction.

Possible Side Effects*

Symptoms of depression, including ongoing sadness, anxiety, loss of interest in daily activities, irritability, low self-esteem, guilt, poor concentration, indecisiveness, confusion, and eating and sleep disturbances, should be reported promptly to physician.

** Since it may be difficult to distinguish between certain common symptoms of MS and some side effects of this drug, be sure to refer to physician if an abrupt change of this type continues for more than a few days.*

COPAXONE (GLATIRAMER ACETATE)

Description	Nursing Consideration
A synthetic compound made up of 4 amino acids (the building blocks of proteins) that are found in myelin. Thought to stimulate T-cells in the body's immune system to change from harmful, pro-inflammatory agents to beneficial, anti-inflammatory agents that work to reduce inflammation at lesion sites. Indication Approved by U.S. FDA to reduce the frequency of relapses in patients with relapsing-remitting MS. Dose 20 mg Frequency Daily Route Subcutaneously (SC) injection	Should be kept refrigerated at all times. If refrigeration is not available, it may be safely stored at room temperature for up to 7 days. Glatiramer acetate is light-sensitive; protect it from light when not injecting. Use each pre-filled syringe for only one injection. An autoinjector is available. An autoinjector is available. Do not reuse needles or syringes. It is recommended that the sites be rotated. Injection site reactions (swelling, redness, discoloration, or pain) are relatively common. Do not use any one site more than once per week. Do not use a pre-filled syringe that appears cloudy or contains particles. Unusual side effects that should be discussed as soon as possible with physician: Hives (an itchy, blotchy swelling of the skin) or severe pain at the injection site. Copaxone may affect Papanicolaou (Pap) test.

GILENYA (FINGOLIMOD)

Description	Nursing Consideration
Partial agonist at the sphingosene-1-phosphate receptor 1. Indication Approved by U.S. FDA for relapsing forms of MS to reduce the frequency of clinical exacerbations and to delay the accumulation of disability.	Observe patient for bradycardia for 6 hours after first dose. Obtain baseline ECG before first dose if not recently available in those at higher risk of bradyarrhythmia. If a patient must discontinue the medication for 2 weeks or longer, she or he must again be observed for 6 hours after the first dose.

Dose

0.5 mg

Frequency

Daily

Route

Orally

Fingolimod may increase the risk of infections. A recent CBC should be available before initiating treatment with fingolimod. Monitor for infections during treatment and for two months after discontinuation. Do not start treatment in patients with active acute or chronic infections. Patients without a history of chickenpox or without vaccination against varicella zoster virus (VZV) should be tested for antibodies to VZV. VZV vaccination of antibody-negative patients should be considered prior to commencing treatment with fingolimod; postpone initiation of treatment for 1 month to allow the full effect of vaccination to occur.

Macular edema can occur with or without visual symptoms. An ophthalmologic evaluation should be performed before starting the medication and again 3-4 months after treatment initiation. Monitor visual acuity at baseline and during routine evaluations of patients. Patients with diabetes mellitus or a history of uveitis are at increased risk and should have regular ophthalmologic evaluations.

Fingolimod can cause a decrease in pulmonary function. Obtain spirometry and diffusion lung capacity for carbon monoxide (DLCO) when clinically indicated.

Fingolimod may increase liver transaminases. Recent liver enzyme results should be available before initiating treatment. Assess liver enzymes if symptoms suggestive of hepatic injury develop and discontinue treatment if significant liver injury is confirmed.

Women of childbearing potential should use effective contraception during and for two months after stopping fingolimod treatment. There is a pregnancy registry for women who accidently become pregnant while on treatment (1-877-598-7237).

	Patients should be instructed to report any signs of slowed heart rate (dizziness, tiredness, slow or irregular heartbeat); infection (fever, tiredness, body ache, chills, nausea, vomiting); changes in vision (blurriness, shadows, or blind spot in the central vision, sensitivity to light, unusually colored vision).

TYSABRI (NATALIZUMAB)

Description	Nursing Consideration
A laboratory-produced monoclonal antibody. It is designed to hamper movement of potentially damaging immune cells from the bloodstream, across the blood-brain barrier into the brain and spinal cord. Indication Approved by U.S. FDA as a monotherapy (not to be used in combination with another disease-modifying drug) for patients with relapsing forms of MS, to delay the accumulation of physical disability and reduce the frequency of clinical exacerbations. Because Tysabri increases the risk of progressive multifocal leukoencephalopathy (PML), it is generally recommended for patients who have had an inadequate response to, or cannot tolerate, any of the other disease-modifying therapies that are available for treating MS. Dose 300 mg Frequency Every 4 weeks	*Warnings: Tysabri increases the risk of progressive multifocal leukoencephalopathy (PML), a viral infection of the brain that usually leads to death or severe disability.* Recommendations Tysabri is not recommended for patients with weakened immune system (e.g. HIV infection/ AIDS, leukemia, lymphoma, or organ transplant recipients). A thorough documentation of allergies, current medical condition, and infection status must be documented before taking Tysabri. Patients are advised to follow up with prescribing physician at the third and sixth month after the first infusion, and at least as frequently as every six months thereafter. Because Tysabri affects the immune system, it can increase the chance of getting an unusual or serious infection (e.g. pneumonia, serious urinary tract infection, gastroenteritis, vaginal infection, tooth infection). *Patients should be instructed to report any new or unusual symptoms immediately.*

Route

Intravenous Infusion (in a registered infusion facility).

Estimated incidence of PML in the Postmarketing setting (as of November 2011)

Number of Infusions:	PML Incidence per 1,000 patients:
Up to 24	0.54
25 to 36	1.96
37 to 48	1.71
49 to 60	1.46

- The risk of PML increases with time on Tysabri, prior treatment with an immunosuppressant medication, and prior exposure to the JC virus (as demonstrated by antibody testing).
- Serious hypersensitivity reactions (e.g., anaphylaxis) have occurred.
- Clinically significant hepatotoxicity has occurred.

Proper Usage

Tysabri is available only through a special distribution program called the TOUCH Prescribing Program. Only physicians, infusion centers, and pharmacies associated with the infusion centers that are registered with the Program can prescribe or deliver the medication. The patient is asked to sign the Prescriber/Patient Enrollment Form. Only those patients who are enrolled in, and meet all the conditions for the Program, can receive the medication.

For More Information on Tysabri

1-800-456-2255

www.tysabri.com

Possible Side Effects*

Some side effects may go away as the body adjusts to the medication and do not require medical attention unless they continue or are bothersome (e.g. headache, pain in arms/legs, feeling tired, joint pain, depression, diarrhea, pain in stomach area). Allergic reactions can occur — including serious ones (e.g. hives, itching, trouble breathing, chest pain, dizziness, chills, rash, nausea, flushing of skin, low blood pressure Serious allergic reactions usually happen within 2 hours of the start of the infusion, but can happen any time after. Patients should be instructed to report any allergic reactions immediately.

** Since it may be difficult to distinguish between certain common symptoms of MS and some side effects of this drug, be sure to refer to physician if an abrupt change of this type continues for more than a few days.*

NOVANTRONE (MITOXANTRONE)

Description

Belongs to the general group of medicines called antineoplastics. Prior to its approval for use in MS, it was used only to treat certain forms of cancer. It acts in MS by suppressing the activity of T-cells, B-cells, and macrophages that are thought to lead the attack on the myelin sheath.

Indication

Approved by U.S. FDA for reducing neurologic disability and/or the frequency of clinical relapses (attacks) in:

- Patients with secondary progressive MS (disease that has changed from relapsing-remitting to progressive at a variable rate)
- Progressive-relapsing MS (disease characterized by gradual increase in disability from onset with clear, acute relapses along the way);
- Worsening relapsing-remitting MS (disease characterized by clinical attacks without complete remission, resulting in a step-wise worsening of disability.

Proper Usage

Novantrone should be used only in those with normal cardiac function. The lifetime cumulative dose is limited to 120–140 mg/m2 (approximately 8–12 doses over 2–3 years) because of possible cardiac toxicity.

Frequency

Administered once every 3 months at a dose of 12mg/m2. Each infusion takes about 5–15 minutes.

Nursing Consideration

The following tests should be done prior to each dose: Echocardiogram, Labs (hematology, urinalysis, urine culture and sensitivity, Beta HCG). Novantrone can increase the risk for infection by decreasing the number of protective white blood cells.

Note: In response to post-marketing findings, the FDA has added a black box warning to the prescribing information for Novantrone:

- Prior to the start of treatment, a person should be carefully evaluated (by examination and medical history) for signs and symptoms of heart disease.
- A baseline evaluation of left ventricular ejection fraction (LVEF) should be performed.
- A person whose LVEF is lower than 50% should not be given Novantrone.
- LVEF should be re-tested prior to each dose of Novantrone.
- Any person whose LVEF changes significantly or drops below 50% should have no further Novantrone treatments.
- The factors that are known to increase a person's risk for cardiotoxicity with Novantrone are:
  - a current or prior history of heart disease
  - the simultaneous use of other medications that can damage the heart;
  - previous therapy with certain kinds of chemotherapies (anthracyclines or anthracenediones).

Refer to physician prior to any immunization/ vaccination. Mitoxantrone may lower the body's resistance to infection, making patient susceptible to the infection.

Route

Intravenous infusion (in a medical facility).

Note: Calculate for BSA (Body Surface Area) to obtain correct dosage: BSA = Height (in) x Weight (lbs)

Novantrone Support Program

MS LifeLines℠

1-800-456-2255

1-877-447-3243

www.mslifelines.com

Possible Side Effects*

Some side effects go away as the body adjusts to the medication and do not require medical attention unless they continue or are bothersome: nausea, temporary hair loss, and menstrual disorders in females. Notify physician immediately if patient complains of fever/chills, lower back or side pain, painful or difficult urination, swelling of feet and lower legs, black tarry stools, cough or shortness of breath, sores in mouth/lips, stomach pain.

** Since it may be difficult to distinguish between certain common symptoms of MS and some side effects of this drug, be sure to refer to physician if an abrupt change of this type continues for more than a few days.*

NO. 7

Nursing Therapeutics

Nurses are in a key position to assist the patient in obtaining his/her optimum level of function. The Nursing Process (Assessment — Nursing Diagnosis — Outcome Identification — Planning — Implementation — Evaluation) can be used to formulate and develop specific care plans that cover physical, psychological, social, cultural, spiritual needs, with continual modification as needed until the highest possible standard of care is achieved.

MS CARE INVOLVES THE FOLLOWING

- Disease Management
- Symptomatic Management
- Quality of Life Interventions
- Relapse Management

Please see Table 9.

NANDA-I APPROVED NURSING DIAGNOSES

- ❑ Activity Intolerance
- ❑ Activity Intolerance, Risk for
- ❑ Airway Clearance, Ineffective
- ❑ Anxiety
- ❑ Aspiration, Risk for
- ❑ Bladder Incontinence
- ❑ Body Image, Disturbed
- ❑ Body Temperature, Risk for Imbalance
- ❑ Bowel Incontinence
- ❑ Breathing Pattern, Ineffective
- ❑ Caregiver Role Strain
- ❑ Caregiver Role Strain, Risk for
- ❑ Communication, Impaired Verbal
- ❑ Conflict, Decisional
- ❑ Constipation
- ❑ Constipation, Risk for
- ❑ Coping, Compromised family
- ❑ Coping, Defensive
- ❑ Coping, Disabled Family
- ❑ Coping, Ineffective
- ❑ Coping, Ineffective Community
- ❑ Denial, Ineffective
- ❑ Diarrhea
- ❑ Disuse syndrome, Risk for
- ❑ Diversional Activity, Deficient
- ❑ Falls, Risk for
- ❑ Family Process, Interrupted
- ❑ Fatigue
- ❑ Fluid Volume, Risk for Deficient
- ❑ Gas Exchange, Impaired
- ❑ Grieving, Anticipatory
- ❑ Health Maintenance, Ineffective
- ❑ Home Maintenance, Impaired
- ❑ Hopelessness
- ❑ Incontinence, Functional Urinary
- ❑ Incontinence, Reflex Urinary
- ❑ Incontinence, Total Urinary
- ❑ Infection, Risk for
- ❑ Injury, Risk for

- ❑ Knowledge, Deficient
- ❑ Memory, Impaired
- ❑ Mobility, Impaired Bed
- ❑ Mobility, Impaired Physical
- ❑ Mobility, Impaired Wheelchair
- ❑ Noncompliance [Adherence, Ineffective]
- ❑ Nutrition: Less than Body Requirements, Imbalance
- ❑ Pain, Acute
- ❑ Pain, Chronic
- ❑ Parenting, Impaired
- ❑ Powerlessness
- ❑ Role Performance, Ineffective
- ❑ Self-Care Deficit, Bathing/Hygiene
- ❑ Self-Care Deficit, Dressing/Grooming
- ❑ Self-Care Deficit, Feeding
- ❑ Self-Care Deficit, Toilet
- ❑ Self-esteem, Chronic low
- ❑ Sensory/Perception, Disturbed (Specify: Visual, Auditory, Kinesthetic, Gustatory, Tactile, Olfactory)
- ❑ Sexual Dysfunction
- ❑ Skin Integrity, Impaired
- ❑ Skin Integrity, Impaired, Risk for
- ❑ Sleep Pattern, Disturbed
- ❑ Social Isolation
- ❑ Sorrow, Chronic
- ❑ Spiritual Distress
- ❑ Spiritual Distress, Risk for
- ❑ Suicide, Risk for
- ❑ Swallowing, Impaired
- ❑ Therapeutic Regimen Management: Ineffective
- ❑ Tissue Integrity, Impaired
- ❑ Transfer Ability, Impaired
- ❑ Urinary Elimination, Impaired
- ❑ Urinary Retention [Acute/Chronic]
- ❑ Walking, Impaired

NURSING CHECKLIST FOR CARING FOR A PATIENT WITH MULTIPLE SCLEROSIS (TO BE COMPLETED AS PART OF THE *NURSING ASSESSMENT*)

Today's Date _____

Patient Name _____

Date of Admission _____

Reason for Admission _____

Discharge Plan _____

Allergies _____

Infection Status _____

❑ MEDICATIONS

- ❍ Is the patient on Disease-Modifying medications? ____Yes ____No
  - ❑ Avonex (Once a week, IM injection)
  - ❑ Betaseron (Every other day, SC Injection)
  - ❑ Extavia (Every other day, SC injection)
  - ❑ Copaxone (Every day, SC Injection)
  - ❑ Rebif (Three times per week, SC Injection)
  - ❑ Tysabri (Every 4 weeks by IV Infusion in a registered infusion facility)
  - ❑ Novantrone (4x a year by IV infusion in a medical facility)
  - ❑ Gilenya (orally once daily)
- ❍ Are these medications to be given during stay? ____Yes ____No
  Date of most recent dose _____
- ❍ Does the patient have a Baclofen Pump/Intrathecal Baclofen? ____Yes ____No

  Baclofen relieves spasms, cramping, and tightness of muscles caused by the spasticity in MS. A Baclofen pump is surgically implanted under the skin of the abdomen. The dose can be adjusted, if necessary, by non-invasive radio-telemetry.

  Last fill date _____ Next dose due_____

IS TREATING NEUROLOGIST AWARE OF ADMISSION? Please call regular neurologist office as courtesy if neurologist is not admitting or consult neurologist. Schedule follow-up appointment as needed.

❑ NURSING CARE

- ❍ Independent
- ❍ Partial Dependence
- ❍ Total Dependence
  - ❑ Safety
    - ❍ Fall Precautions
    - ❍ _____
  - ❑ Nutrition
    - ❍ Aspiration Precaution
    - ❍ Assistance with meals
  - ❑ Activity/Mobility
    - ❍ Ambulatory
    - ❍ Confined to Bed
    - ❍ Use of assist devices types _____
    - ❍ Wheelchair
      - ❑ Electric
      - ❑ Manual
      - ❑ Full time
      - ❑ Part time
  - ❑ Bowel/Bladder Function
    - ❍ Frequency/Urgency
    - ❍ Incontinent
    - ❍ Catheter
  - ❑ Skin Integrity
    - ❍ Dressing change
    - ❍ Turning and positioning
    - ❍ Topical products
  - ❑ Other: _____

❑ REFERRALS

- ❍ Physical Therapy
- ❍ Occupational Therapy
- ❍ Physical Medicine
- ❍ Speech/Swallow Therapy
- ❍ Respiratory Therapy
- ❍ Wound Care
- ❍ Pulmonology
- ❍ Neuropsychology
- ❍ Psychiatry
- ❍ Gastroenterology
- ❍ Urology
- ❍ Ophthalmology
- ❍ Vocational Rehabilitation
- ❍ Social Worker/Case Management
- ❍ National MS Society
- ❍ Other: _____

NURSE'S SIGNATURE/DATE

_____

TABLE 9: NURSING THERAPEUTICS

Nursing Diagnosis	Goals
Safety, risk for Injury due to environment	■ The patient and/or family member/significant other will: • Identify actual and high-risk environmental hazards. • Demonstrate safety habits appropriate to selected environments (home, healthcare setting, workplace, community). ■ The patient will: • Experience a decrease in the frequency and severity of injury events. • Feel safe within their environment and be able to identify support systems to help them maintain a safe environment

Interventions
Protect patients from environmental hazards. ■ Anticipate and minimize the adverse consequences of procedures and treatments. ■ Promote safety and security: • Introduce patient to staff. • Orient patient to environment (instruction on the use of call light, bed controls, location of bathroom, and schedule of unit activities). • Ensure that the patient's room is uncluttered and free of obstacles especially between the bed and the bathroom. • Talk to patient and answer questions calmly and confidently to increase the client's/patient's security. Always maintain a good rapport with patient and/or family member/significant other. ■ Institute a fall prevention program • Clean up damp areas promptly. Remove throw rugs. • Provide equipment and directions and for emergency call system • Install handrails whenever needed, avoid unstable ladders/stepstools. • Make sure stairways are well lighted and repaired. • Instruct patient not to attempt to do anything beyond arm's reach or beyond physical activity limits. • Always eat or drink using a table or tray. ■ Provide instruction on motor vehicle safety • Proper use of seatbelts. • Maintain a safe driving speed for road and weather conditions. • Use of adaptive driving devices and equipment, driving evaluation as necessary.

- Promote burn prevention
  - Manage water temperature in home, instruct on environmental risks in patients with decreased sensation. Instruct on skin inspection.
  - Minimize cooking accidents, use lightweight dishes, pots, and potholders, use cooking thermometers.
  - Discuss or review evacuation strategy for occupants.
  - Consult Vocational Rehabilitation if risk of burns exists with occupation.
- Promote fire safety
  - Promote use of fire and smoke alarms, CO_2 detectors and fire extinguishers.
  - Notify local fire department that disabled person lives in area.
- Assess for signs of domestic violence
  - Assess patient away from potential perpetrator.
  - Observe for symptoms during assessment, assess pattern of injuries and determine if they match explanation of any injury.
  - Explore stress level in environment.
  - Provide referrals for both safety and emotional support including the National Domestic Violence Hotline (800-799-SAFE or 1-800-787-3244).
- Collaborate and/or refer: rehabilitation physician, physical therapist, occupational therapist, speech language pathologist.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert

Patients with neurological disorders may be at higher risk for domestic violence. Domestic violence occurs in women at significantly higher rates than in males.

Nursing Diagnosis	Goals
Activity intolerance related to weakness Mobility impairment related to musculoskeletal and or neuromuscular dysfunction	■ The patient will: • Increase endurance and tolerance for physical activity. • Maintain optimal function despite mobility restrictions. ■ The patient and/or family member/significant other will: • Actively participate in prescribed therapies. • Actively participate in measures to prevent potential complications of immobility.

Interventions

- Encourage physical fitness promotion
  - Provide range of motion (ROM) exercises. ROM is the ability to move all joints through the full extent of intended function.
  - Instruct and/or demonstrate aerobic exercises — most beneficial when performed 3–5x/week for at least 30 minutes per day.
  - Encourage strength training to increase ROM.
  - Demonstrate regular Weight-bearing exercise.
- Assist with osteoporosis prevention
  - Assess and refer for bone density tests in high-risk individuals (e.g. women post-menopause, patients with history of osteopenia or osteoporosis , frequent fractures, or long term use of IV methylprednisolone).
  - Provide lifestyle modification (smoking cessation, alcohol and caffeine consumption).
  - Instruct concerning dietary modifications (diet rich in calcium, vitamin D).
- Injury Prevention
  - *(See "Safety").*
  - Counsel patient about drug and alcohol use and effect on CNS.
- Instruct about/provide for therapeutic positioning to prevent complications when mobility is limited.
  - Maintain proper body alignment and support all body parts.
  - Avoid pressure, especially over bony prominences, by adequately padding these areas.
  - Use positioning aids (e.g. pillows, footboards, sheepskin protectors).
  - Turn and reposition immobile patients every 2 hours or as necessary.
- Teach patient and/or family member/significant other of the proper use of any assistive device (e.g. cane, crutches, walker, scooter and wheelchair) and any transfer device/equipment (e.g. hydraulic lifts, hoyer lifts, Stand-Up assist lifts).
- Instruct patient and family as to how to perform skin assessment and frequency required.
- Collaborate and/or refer: rehabilitation physician, physical therapist, occupational therapist, wound and ostomy care nurse.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert:

- When in doubt, seek assistance before beginning to move a patient. Examine the surroundings for potential obstacles to the desired movement (e.g. equipment, cord, tubing or other items that could trip the nurse or hamper the patient's free movement.

- Patients should increase exercise tolerance gradually to avoid excessive stress on muscles and joints. Pain during exercise is a signal to stop.
- To prevent further trauma and injury, move the body as a unit so the spinal column does not bend or twist.
- Have the patient wear shoes or slippers with non-skid soles, and clear the path of obstacles. Many hallways have railings the patient can grip. A weak or unstable client may prefer to push a chair or wheelchair to provide extra support and balance. Encourage the patient to look straight ahead to promote balance and prevent dizziness.
- Prompt replacement or repair of damaged assistive devices can prevent falls, injuries.

Nursing Diagnosis	Goals
Self-Care and hygiene deficit related to neurologic impairments	■ The patient and/or family member/significant other will: • Actively participate in hygiene measures. • Actively participate in performing and managing activities of daily living (ADL). • Safely increase level of independence in performing ADL.

Interventions

- Emphasize the importance of increasing independence in self-care.
- Stress the relationship of good hygiene, optimal health, and infection prevention.
  - A shower is advised prior to treatments including injection, wound care to limit, if not eliminate possible infection at site
- To ensure asepsis, instruct to wash from clean areas to dirty areas when possible.
  - Before doing injections, cleanse the site with antiseptic swab, wiping from the center of the site and rotating outward, pulling any contamination away from the intended injection site. Instruct to monitor previous injection sites.
- Teach patients with self-care deficits new skills or methods of overcoming or coping with difficulties.
- Be sensitive to the patient's preference and respect the client's sense of privacy and modesty.
  - Curtains should be pulled around beds and door closed when bathing or dressing patients.
- Assess for factors affecting self-care include culture, values and beliefs, environment, motivation, emotional status, cognitive abilities, energy, severity of illness, pain and motor deficits.

- Teach patient the importance of mouth care and how to properly clean mouth: brush teeth twice daily, use floss and rinse afterwards and rinse mouth after meals. Assess for symptoms of xerostomia (excessive thirst, burning tingling sensation in mouth, red raw tongue, sores in mouth, difficulty swallowing. Use mouth moisturizers and hydrate to combat dryness, avoid alcohol, limit spicy, salty or foods with high sugar content, foods with high acid levels for increased comfort and healing.
- Collaboration and/or referral — rehabilitation physician, physical therapist, occupational therapist, speech language pathologists and dentist.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Interventions

Nursing Safety Alert

- Patients who suffer dizziness, weakness should not be allowed to take stand-up showers. The installation of grab bars and the use of shower chair are highly recommended. Patients may become overheated and weak during the bathing process.
- Handwashing is the most significant measure to decrease the transient growth of microorganisms.
- Risks of xerostomia include: decreased oral intake, dental caries, tooth loss, periodontal disease, oral candidiasis, infections to other parts of body.

Nursing Diagnosis	Goals
Fluids, electrolytes, nutrition deficits related to insufficient intake	■ The patient will : • Reestablish normal extra cellular fluid (ECF) volume, water, and/or electrolyte balance. • Remain free of complications from fluid or electrolyte imbalance. • Use nutritionally sound dietary intake to meet body requirements and to promote health. • Maintain dietary intake adequate to meet the body's energy expenditures. • Achieve and maintain desired weight. ■ The patient and/or family member/significant other will: • Demonstrate knowledge regarding how to promote future ECF volume, water and electrolyte balance. • Demonstrate adequate knowledge to adhere to dietary prescription or therapies to promote health.

Interventions

- Provide adequate hydration
  - Monitor vital signs, output with sudden decrease in fluid intake. Assess typical daily fluid intake. Fluid intake is ideally 6–8 glasses of fluid, preferably water, everyday except in cases where severe bladder overactivity exists, or when the patient exhibits swallowing difficulties. Patients may significantly limit fluid intake over time to manage bladder and bowel dysfunction. Caffeinated beverages (coffee, tea, cola) and alcohol can have a diuretic effect, thus dehydrating the patient while increasing urination.
- Provide electrolyte supplements as ordered — when normal dietary intake is insufficient, electrolyte supplements may be administered orally or intravenously.
- Assess for muscle cramping, twitching, confusion or nausea, signs of electrolyte imbalance.
- Assess oral cavity for source of limited intake such as xerostomia. *(See "Self care deficits").*
- Promote good nutrition.
  - Increase understanding of the importance of a healthy diet, especially encouraging the patient to ingest the recommended intake of protein daily. Protein requirements are increased with stress and/ or infection.
  - Informal dietary instruction can occur when helping patients make menu selections.
  - Praise food choices, emphasizing the importance of each food in maintaining health.
  - Assess how meals are provided in home and look for family community supports to provide nutritious meals on a daily basis.
  - Referral to Meals on Wheels program, if meal preparation is a problem.
  - Serve food in attractive, appetizing manner and at the right temperature.
  - Consider food preference but do not sacrifice nutrition value.
  - Provide small frequent, easy to chew, swallow high calorie meals to minimize fatigue.
- Maintain a conducive dining atmosphere (e.g. room should be well ventilated, clean, and free of strong odors).
  - Oral care before and after eating promotes comfort and taste.
- Teach patient and/or family member/significant other of the proper use of any assistive feeding device and assistive food preparation device.
- Provide appropriate dietary instruction.
  - Nutritional supplements, in the form of formulas, vitamins, minerals and protein, may be added to prescribed diets to provide necessary nutrients, especially during periods of increased metabolic demands such as infection, skin breakdown.
  - Instruct families regarding Heimlich maneuver.
  - Tube feedings provide nutrition to clients with functional gastrointestinal (GI) systems who cannot swallow or who have an esophageal obstruction.

  - Assess proper tube placement before beginning tube feedings to prevent accidental aspiration of feedings and do not use if any concern regarding proper placement arises.
  - Suction machine should be available at bedside.
  - Proper positioning before and after feedings (head of bed 30–45°).
- Weigh patient and instruct patient to be weighed on a routine basis. If assessment of weight difficult to perform due to immobility of patient, discuss with primary care physician or neurologist as to options.
- Collaborate and/or refer — nutritionist, dietitian, speech/language pathologist, occupational therapist.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert

- Patients who have marked ECF volume deficit may become faint or dizzy when they stand, have help available and be vigilant to prevent patient injury when taking postural vital signs.
- Subtle changes in the person's ability to understand and relate to his/her environment can be the earliest indication of a fluid or electrolyte imbalance.
- When there is any doubt as to the patient's ability to swallow, do not try to feed him/her until obtaining an expert opinion. Wait until a complete evaluation is done.
- Patients with gastroesphogeal reflux, other upper digestive conditions, as well as dysphagia are at greater risk of aspiration pneumonia, even in the presence of tube feedings.
- Always ask patients about allergies to foods, drugs, or supplements they currently use to prevent allergic reactions and incompatibilities.
- Because of the risk of fluid aspiration into the lungs, the unconscious client should be turned on the side during mouth care so fluids can drain easily. Low level suction may be needed to remove fluid from mouth when cleaning.
- Proper mouth care can limit aspiration risk long term.

Nursing Diagnosis	Goals
Altered respiratory function related to muscle weakness	■ The patient and/or family member/significant other will: • Demonstrate knowledge regarding prevention of respiratory dysfunction. • Effectively cope with changes in self-concept and lifestyle. ■ The patient will: • Have adequate oxygenation. • Mobilize pulmonary secretions.

Interventions

- Prevent Respiratory Infections
  - Encourage good nutrition and hydration. *(See "Fluid Electrolyte, Nutrition")*.
  - Avoid exposure to known infected people or large crowds during peak flu season.
  - Discuss potential of receiving vaccines with patient, medical physician and neurologist (flu and pneumovax).
  - Encourage good hygiene (e.g. handwashing, proper used tissue disposal, minimizing spread of respiratory secretions from coughing and sneezing).
  - Reduce exposure to allergens. Encourage smoking cessation.
  - Assess oral muscles and ability to chew, swallow without coughing.
- Energy conservation — make suggestions for modifying ADLs based on thoroughly assessing the extent to which respiratory dysfunction has affected each activity.
  - Sponge baths may be a practical alternative to tub bathing.
  - An elevated toilet seat or bedside commode may help decrease the effort required to toilet.
  - Slowly increase activity level if recent pulmonary infection.
- Encourage deep breathing and coughing exercises at prescribed intervals.
- Assist with incentive spirometer exercises only if prescribed. Instruct patient family to document results on routine basis and assess for changes indicating respiratory system changes, neurologic changes, or infection.
- Provide chest physiotherapy, aerosol therapy or allow appropriate staff to perform at prescribed intervals. Instruct patient and family as to proper cleaning and handling of equipment.
- Oxygen therapy, as directed. Insure proper use and adequate supply. Instruct patient and family regarding home safety. Make sure emergency numbers available.
- Assess lips and nostrils for dryness, encourage water based lubricants. Assess skin that touches tubing and monitor for irritation.
- Assist patient with use of BiPAP, CPAP machines as directed.
- Instruct patient and family as to proper suction equipment use and Heimlich maneuver.
- Collaboration and/or referral: respiratory therapist, pulmonologist, physiatrist, physical therapist, occupational therapist, speech language pathologist.
- Always involve family member/significant other with plan of care, including Personal Care Attendants and Certified Nurse Assistants.

Nursing Safety Alert

- Changing positions and movement in general help to shift respiratory mucus into portions of the airways where it may generate cough, making expectoration easier. It prevents mucus from pooling, which, in turn, decreases the risk of bacterial colonization and infection.
- The most common cause of airway obstruction is the tongue, which can fall back into the airway and interfere with ventilation and gas exchange. Positioning the patient on either side can relieve the obstruction. If such a position is undesirable or impractical, an oral or nasal airway may be needed.
- As the muscles that control breathing weaken, the ability to cough can be impaired, leading to an increased risk for pneumonia.
- The nurse who discovers the choking victim should stay with the victim while calling for help. The person arriving first to help will be ready to alert the cardiopulmonary resuscitation team, if necessary, and to offer other support. The nurse must then take immediate action to clear the obstruction by using the Heimlich maneuver.
- Risk of developing respiratory infections is increased in some patients receiving disease modifying medications.

Nursing Diagnosis	Goals
Cardiac Function, Alteration related to decreased activity level	■ The patient and/or family member/significant other will: • Demonstrate adequate knowledge concerning cardiovascular dysfunction, prevention or care. • Effectively cope with resulting changes in self-concept and lifestyle. ■ The patient will: • Maintain adequate cardiac output. • Demonstrate adequate tissue perfusion with adequate oxygenation of body tissue. • Discuss how a healthy lifestyle can decrease heart disease RISK.

Interventions

- Prevent venous stasis — patients with limited mobility are prone to have edema and the formation of deep vein thrombosis (DVT).
  - Assist with leg exercises.
  - Apply antiembolism stockings while patient is in bed and teach family to do the same.
  - Apply a Sequential Compression Device (SCD) as prescribed.

- Assist with edema reduction
  - Elevate limbs during day to prevent nocturnal diruesis.
  - Provide appropriate dietary instruction. *(See "Nutrition")*.
  - Instruct on proper use of lymphedema pump when indicated being careful not to overload cardiac system.
- Encourage patient to decease risk though the following behaviors: smoking cessation, maintain healthy weight, exercise on a routine basis, reduce cholesterol though medication or diet, monitor blood pressure, participate in stress reduction exercises or activities.
- Instruct patient as to proper use of BiPAP, CPAP if prescribed. Refer to prescribing physician if patient experiences difficulty using equipment or finds equipment to be ineffective against symptoms.
- Collaboration and/or referral: rehabilitation physician, cardiologist, physical therapist, occupational therapist, nutritionist/dietitian, respiratory therapist.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert

- Teach patient or family member/significant other never to ignore chest pain or discomfort and to report such unrelieved symptoms to medical personnel immediately.
  - When cardiac and/or respiratory factors are not found to be source of symptoms, encourage patient to notify neurologists. Lesions in spine may be responsible.
- Inspect the clients/patient's legs and feet regularly to ensure that the stockings do not impair circulation.

Nursing Diagnosis	Goals
Bladder elimination alterations related to nerve damage and immobility	■ The patient will: • Reestablish control over voiding. • Strengthen or maintain adequate perineal muscle control. ■ The patient and/or family member/significant other will: • Verbalize understanding of procedures necessary to promote optimal urinary function.

Interventions

- Promote water intake to flush microorganisms out of the urinary system, thus decreasing the chance of urinary tract infection (UTI) or obstruction caused by stones. *(See "Fluids and Electrolytes").*
- Assist with bladder training to prevent urinary incontinence.
  - Voiding schedule (e.g. every 2 hours).
  - Instruct patient to alter diet.

- Limit irritating liquids such as diet drinks, caffeinated beverages, alcohol. Limit fluids by early evening. Drink fluids in bulk early in day.
- Encourage venous return in afternoon by keeping legs elevated if fluid retention occurs.

- Promote muscle-strengthening exercise
  - Consult rehabilitation specialist for pelvic floor strengthening exercises.
- Assist with proper use of catheters
  - Provide appropriate instruction for intermittent self catheterization (ISC).
  - Foley catheters for patients experiencing incontinence or urinary retention may be needed when skin breakdown exists. Its use is suggested for those individuals who cannot be managed with intermittent self catheterization and/or medications, or who have chronic decubitus and cannot perform ISC.
    - Cleanse the client's/patient's perineal area and the catheter at least 2x/day gently with soap and water and with any incontinence to help prevent infection.
  - Suprapubic catheters may be associated with a lower risk of UTI.
- Manage bladder medications. *(See Chapter 7)*.
- Encourage patient with recurrent UTIs to reduce urinary infection risk by increasing intake of cranberry juice or tablets, decreasing intake of citrus juices and red meats, and taking anti-infective medication (e.g., methenamine mandelate or hippurie acid) if prescribed.
- Collaborate and/or refer — neurourologist or urologist, physical therapist, occupational therapist.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert

- Intermittent self catheterization permits the patients with chronic neurogenic bladder greater control and independence in self-care. Also the incidence of UTI is less, than with a retention catheter. Catheters should not be cleaned and reused.
- Long-term use of indwelling urethral catheters is a significant source of bacteria and the most common cause of UTI. Management varies, but the usual practice is to change the catheter after a minimum of 30 days or PRN. If the patient has a symptomatic UTI, the entire system must be changed and a urine culture obtained. Urethral catheter use should be limited and consider suprapubic insertion if catheter is required long term.
- Consider an SP tube if a patient has been using a urinary catheter for greater than one month. Site is to be washed once daily and use of occlusive barrier creams at site are recommended. Foam gauze dressings can be used at site to absorb small amount of purulent drainage that occasionally drains from site. Monitor site for skin infections e.g. redness change in drainage, bleeding and pain. Drainage bags (day and night if patient varies use of sizes) need to be cleaned daily with vinegar and water solution or bleach solution. If patient has history of recurrent infection, then bags should be discarded after weekly basis. Patient should be provided with options in collection devices to encourage independence.

Nursing Diagnosis	Goals
Bowel Elimination: altered patterns related to nerve damage and immobility	■ The patient will: • Demonstrate a normal pattern of bowel elimination without evidence of constipation, diarrhea, fecal incontinence or distention. • Remain free of preventable complications or adverse consequences from altered bowel elimination. ■ The patient and/or family member/significant other will: • Participate in a program to maintain and promote an acceptable pattern of bowel elimination.

Interventions

- Assess for GI symptoms, reflux, pain, urgency, incontinence, hemorrhoids, bleeding.
- Assist patient with planning a diet that contains sufficient daily intake of high-fiber foods (e.g. fruits, vegetable, whole-grain breads and cereals) to provide bulk to the stool.
- Encourage adequate fluid intake 6–8 glasses per day unless with severe bowel or bladder dysfunction.
- Assist with design of activity and exercise program — important for normal intestinal functioning.
- Provide bowel training — aims to maintain a soft stool consistency and develop a routine method of stool evacuation.
- Consider pelvic floor therapy for symptoms.
- Set up calendar to monitor movements.
- Medication Management. *(See Chapter 6, "Pharmacotherapeutics").*
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert

- Never administer more than 3 tap water enemas (or total of 1000ML). Excess absorption of the hypotonic solution by colonic mucosa leads to fluid and electrolyte imbalances. If the enemas are not effective, consider alternative therapies.
- Forceful pressure against the rectal mucosa can damage the bowel tissue.

Nursing Diagnosis	Goals
Sleep deprivation related to neurological status or mood Fatigue related to disease process	■ The patient will: • Report fewer problems falling asleep. • Report feeling more rested especially early in day. • Demonstrate physical signs of being rested such as increased activity level.

Interventions

- Encourage patients to establish a quiet, darkened environment modified according to their preferred level (e.g. low light).
- Note any disturbance in sleep pattern (e.g. inability to fall asleep, stay asleep).
  - Fatigue from sleep disturbances is usually managed by addressing the symptoms or problems that interfere with sound sleep and include psychological issues, spasticity, leg cramps, nocturia, or pain.
  - Identify the sources of sleep problems (e.g. periodic limb movements, spasms, snoring, or apnea). A sleep partner may also be able to provide valuable information about limb movements or spasms that occur during the night. A referral to a sleep specialist may be necessary especially if the specific cause(s) of the sleep disturbance are not readily apparent. It is important to address any sleep problems as they can contribute significantly to daytime fatigue.
- Patients may limit fluid intake beginning early in the evening or elevate legs in afternoon or early evening in presence of fluid retention to limit nocturia.
- Instruct on use of relaxation exercises at bedtime.
- Assist with voiding before retiring, and appropriate positioning in bed to limit urinary symptoms and pain.
- Provide a urinal/bedpan or bedside commode within reach.
- Help patient to establish a consistent rising time. Getting up is subject to voluntary control, whereas falling asleep usually is not. Slightly decreasing the time in bed solidifies sleep and, along with a consistent rising time, will finally lead to more regular times of sleep onset.
- Provide for short nap or quiet time in the afternoon, do not allow for a nap longer than 20 minutes if trying to establish or instruct on a routine.
- Assist and instruct patient on any assistive breathing devices. *(See "Respiratory").*
- Promote rest periods with increasing activity, instruct patient to use energy conservation measures.

Interventions
■ Encourage exercise program. ■ Instruct patient to prioritize activities and delegate as needed. Use technology to assist in daily activities. ■ Collaborate and/or refer: rehabilitation physician, physical therapist, occupational therapist, speech language pathologist, look to community resources for home organization, vocational rehabilitation. ■ Always involve family member/significant other with plan of care, including personal care attendants and Certified Nurse Assistants. ■ Provide instruction on medications (e.g., eszopiclone, zolpidem should be used cautiously as not to develop tolerance and lack of effectiveness with nightly use). Nursing Safety Alert ■ Caution patients with impaired gas exchange or sleep apnea to use sedatives and alcohol cautiously, if at all. ■ Encourage patients to seek assistance when getting up, especially at night, if they are at risk for dizziness or have impaired mobility.

Nursing Diagnosis	Goals
Altered skin integrity and wound healing related to immobility and altered nutrition	■ The patient's skin will: • Remain intact without areas of local inflammation. • Demonstrate evidence of healing. ■ The patient and/or family member/significant other will: • Verbalize understanding of preventive skin care.

Interventions
■ Provide appropriate skin care • Avoiding mechanical irritation or injury from rubbing or friction can prevent skin breakdown. • Minimize chemical irritation (e.g. use mild soap, plain water or products that contain emollients). • Maintain adequate hydration. Avoid drying agents (e.g. alcohol). Use lotions or creams with lanolin. ■ Patients who are incontinent of urine or stool or who perspire excessively need prompt, thorough and frequent washing and drying. Areas where skin lies in folds (e.g. under the breasts and in gluteal areas) can collect moisture and require special attention. • An absorbant pad or light dusting of powder may be used to prevent moisture buildup in skin folds.

- Discuss daily dietary intake and assess for adequate nutrition. *(See "Nutrition").*
- Assess for adequate circulation — treating underlying cardiac or circulatory problems helps ensure adequate blood flow to the skin.
- Assess urinary and bowel continence as denuded skin can result on the buttocks or perineal area, it is often a result of urinary or fecal incontinence.
  - A urinary catheter may be necessary temporarily to allow the skin's surface to re-epithelialize.
  - Options for protecting skin from incontinent stool include adult briefs and protective ointments, rectal pouches and rectal tubes.
- Provide appropriate wound care and dressing changes.
  - Hydrogels are used to encourage granulation with full-thickness wounds and to provide comfort in tender, partial-thickness wounds.
  - Alginate products are known for their capacity for absorption. It is indicated for deep or moderately draining wounds.
  - The frequency of dressing changes is determined by wound status, type of dressing, amount of drainage, and frequency of wound assessment required.
- Collaborate and/or refer: wound, ostomy, and continence certified nurse, home care nurse, rehabilitation physician, physical therapist, occupational therapist, nutritionist/dietitian, rehabilitation engineers.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Safety Alert

- Move and reposition immobile patients carefully to prevent injury to the skin as a result of shearing force.
- Alert patients to take extra care when adding oil to tub bath water because oil makes the bathtub slippery and may contribute to falls.
- Utmost caution must be taken when heating pads are used. During heating pad use, inspect the skin frequently, especially for clients with decreased sensation. Thermal burns may result.
- Physical and occupational therapists can be certified as assistive technology practitioners and help with selecting appropriate technology and provide training with selective devices.
- Rehabilitation engineers and technologists are certified providers who use engineering principles who use engineering principles to make customize and fabricate assistive devices.

Nursing Diagnosis	Goals
Changes in self-concept related to illness	■ The patient will: • Integrate a realistic body image. • Express positive feelings about self or self-capabilities.

Interventions

- Assist patients in identifying their strengths.
  - Good sense of humor. A nice smile.
  - Good communication skills.
  - Strong social support system.
- Encourage patients to cultivate their strengths and to use them in the coping process whenever the self is threatened.
- Communicate hope in interactions
- Develop a strong therapeutic relationship; conveying a sense of friendship and trust helps establish rapport with patients.
- Empathize.
- Collaborate and/or refer — psychologists, neuropsychologists, psychiatrists, social workers, National MS Society support groups.

Nursing Diagnosis	Goals
Ineffective stress, coping and adaptation related to changes in physical and psychological changes	■ The patient will: • Identify sources of stress in his or her life. • Identify usual personal coping strategies for stressful situations. • Demonstrate positive coping skills and strategies.

Interventions

- Assist patients to recognize signs and symptoms of stress, to identify sources of distress and to choose appropriate and safe responses.
- Teach stress management — assist patients to find techniques that are most effective for them.
- Reduce stressors — stay away from potentially stressful situations.
- Acknowledge role changes — assist with identification of the impact of illness on family and provide professional supports to assist with working through new role changes.

- Encourage family involvement to adaptations as a result of disability.
- Addressing perfection — perfectionistic "shoulds, oughts and musts" may compound a negative response to stress. Encourage patients to be realistic about how much they can and need to accomplish.
- Encourage assertive behavior — enables patients to act in their best interests, to express their feelings openly and honestly.
- Assess for negative behaviors such as overuse of alcohol, drugs, sexual promiscuity, inappropriate or illegal activities.
- Encourage patients to get adequate rest/nutrition — any person will be more capable of handling daily stressors if the body is not fatigued or malnourished.
- Suggest ways to modify the environment in order to minimize environmental stressors.
- Assess financial distress: Financial counselors, social workers, pharmaceutical assistance programs and Society staff may provide sources of financial assistance and insurance options and programs available in area.
- Provide crisis intervention and assess for adequate support during a crisis and its resolution can help clients realistically perceive the problem or stress and relearn or reinstitute coping strategies.
- Provide referrals to support groups, which are a form of self-help in which people with a common problem get together to share information, feelings and ideas — or just to listen.
  - The National Multiple Sclerosis Society sponsors more than 1,500 support groups. Among the most common are groups for the newly diagnosed, for those with more severe disability, and for couples, spouses or children.
- Collaborate and/or refer — social worker, psychologist, stress management programs and financial planners.
- Always involve family member/significant other with plan of care, including personal care attendants and certified nurse assistants.

Nursing Diagnosis	Goals
Alteration in spiritual health related to disease	■ The patient and/or family member/significant other will: • Express acceptance of current life situation including satisfaction with the meaning and purpose of illness, suffering and death. • Participate in spiritual practices that are personally supportive and will express satisfaction with spiritual condition. • Relate feelings of support in decisions regarding health regimens. ■ The patient will: • Express a sense of wholeness or integrity during the illness and recovery process.

Interventions
■ Listen and support. • Respect and encourage a person's spiritual and religious interest and concerns enhances the healing process. • Spiritual support includes communicating love, forgiveness, meaning, purpose and hope in a time of discouragement and anxiety. • Encourage formal worship if the patient desires as a way to maintain a connectedness with community. ■ Collaborate and/or refer — Chaplain, religious centers within community.

Nursing Diagnosis	Goals
Health maintenance and risk of neglect related to changes in neurologic status.	■ The patient and/or family member/significant other will: • Identify areas for improvement in health maintenance. • Maintain or improve current health status.

Interventions
■ Remind patients and/or family member/significant other that people living with MS are not immune from other health problems (e.g. cancer, heart disease, stroke). ■ Encourage routine physical examination/health screening. Health promotion and disease prevention are most important. (Pay attention to the basic health measures: blood pressure measurement, breast examination, Pap tests, prostate examination, blood sugar level, cholesterol and lipids monitoring.) ■ Provide information about the importance of exercise for people living with MS. ■ Encourage participation in wellness care activities. ■ Provide referrals to weight loss programs and to health professionals or organizations that can help the client eat and exercise in a healthy fashion. ■ Teach patient and/or family member/significant other education about the nature of multiple sclerosis with emphasis on adherence to therapy, common side effects of medications, and to promptly identify/report any signs/symptoms of relapse/exacerbations. ■ Teach patient and/or family member/significant other about lifestyle modification, especially those that could cause a relapse/exacerbation or pseudoexacerbation (e.g. extreme heat exposure). ■ Assess patient's ability to move in community and provide for rehabilitation team if mobility an issue or referrals or social worker or National MS Society if transportation or funding is barrier to keeping appointments. Foster support group of family, friends and community.

- Identify barrier free care centers in area for patient to receive care and phone ahead when increased assistance may be needed so care is not limited at appointments.
- Maintain normal activities and responsibilities as much as symptoms and disease allow. Adopt a "rehabilitation approach that emphasizes maintenance of activities despite the presence of symptoms and limitations. Good coping skills can be used to manage deficits and apply solutions to challenges.
- Provide information related to respite care options in community.
- Discuss insurance options and programs for continuing well care.
- Collaborate and/or refer — primary care physician, neurologist, physical therapists, National MS Society.

Glossary

ABDUCTOR MUSCLE

A muscle used to pull a body part away from the midline of the body (e.g. the abductor leg muscles are used to spread the legs).

ADDUCTOR MUSCLE

A muscle that pulls inward toward the midline of the body (e.g. the adductor leg muscles are used to pull the legs together).

ANKLE-FOOT ORTHOSIS (AFO)

An ankle-foot orthosis is a brace, usually plastic, that is worn on the lower leg and foot to support the ankle and correct foot drop. By holding the foot and ankle in the correct position, the AFO promotes correct heel-toe walking.

ASSISTIVE DEVICES

Any tool that is designed, fabricated, and/or adapted to assist a person in performing a particular task (e.g. cane, walker, shower chair.

ASSISTIVE TECHNOLOGY

A term used to describe all of the tools, products, and devices, from the simplest to the most complex, that can make a particular function easier or possible to perform.

AUTOIMMUNE DISEASE

A process in which the body's immune system causes illness by mistakenly attacking healthy cells, organs, or tissues in the body that are essential for good health. Multiple sclerosis is believed to be an autoimmune disease, along with systemic lupus erythematosus, rheumatoid arthritis, scleroderma, and many others. The precise origin and pathophysiologic processes of these diseases are unknown.

AXON

The extension or prolongation of a nerve cell (neuron) that conducts impulses to other nerve cells or muscles.

AXONAL DAMAGE

Injury to the axon in the nervous system, generally as a consequence of trauma or disease. This damage may involve temporary, reversible effects or permanent severing of the axon. Axonal damage usually results in short-term changes in nervous system activity, or permanent inability of nerve fibers to send their signals from one part of the nervous system to another or from nerve fibers to muscles. The damage can thus result in a variety of symptoms relating to sensory or motor function.

B-CELL

A type of lymphocyte (white blood cell) manufactured in the bone marrow that makes antibodies.

BABINSKI REFLEX

A neurologic sign in MS in which stroking the outside sole of the foot with a pointed object causes an upward (extensor) movement of the big toe rather than the normal (flexor) bunching and downward movement of the toes.

BLOOD-BRAIN BARRIER

A semipermeable cell layer around blood vessels in the brain and spinal cord that prevents large molecules, immune cells, and potentially damaging substances and disease-causing organisms (e.g. viruses) from passing out of the blood stream into the central nervous system (brain and spinal cord). A break in the blood-brain barrier may underlie the disease process in MS.

BRAINSTEM

The part of the central nervous system that houses the nerve centers of the head as well as the centers for respiration and heart control. It extends from the base of the brain to the spinal cord.

CENTRAL NERVOUS SYSTEM

The part of the nervous system that includes the brain, optic nerves, and spinal cord.

COGNITIVE IMPAIRMENT

Changes in cognitive function caused by trauma or disease process. Some degree of cognitive impairment occurs in approximately 50–60 percent of people with MS, with memory, information processing, and executive functions being the most commonly affected functions.

COGNITIVE REHABILITATION

Techniques designed to improve the functioning of individuals whose cognition is impaired because of physical trauma or disease. Rehabilitation strategies are designed to improve the impaired function via repetitive drills or practice, or to compensate for impaired functions that are not likely to improve. Cognitive rehabilitation is provided by psychologists and neuropsychologists, speech/language pathologists, and occupational therapists.

CORPUS CALLOSUM

The broad band of nerve fiber tissue that connects the two cerebral hemispheres of the brain.

CORTEX

The outer layer of brain tissue.

CRANIAL NERVES

Nerves that carry sensory, motor, or parasympathetic fibers to the face and neck. Evaluation of cranial nerve function is part of the standard neurologic exam.

DEMYELINATION

A loss of myelin in the white matter of the central nervous system (brain, spinal cord).

EXTENSOR SPASM

A symptom of spasticity in which the legs straighten suddenly into a stiff, extended position. These spasms, which typically last for several minutes, occur most commonly in bed at night or on rising from bed.

FLEXOR SPASM

Involuntary, sometimes painful contractions of the flexor muscles, which pull the legs upward into a clenched position. These spasms, which last two to three seconds, are symptoms of spasticity. They often occur during sleep, but can also occur when the person is in a seated position.

GADOLINIUM

A chemical compound that can be administered to a person during MRI to help distinguish between new lesions and old lesions.

GADOLINIUM-ENHANCING LESION

A lesion appearing on MRI, following injection of the chemical compound gadolinium that reveals a breakdown in the blood-brain barrier. This breakdown of the blood-brain barrier indicates either a newly active lesion or the re-activation of an old one.

GREY MATTER

A major component of the central nervous system, consisting of neuronal cell bodies, neuropil (dendrites and both unmyelinated axons and myelinated axons), glial cells (astroglia and oligodendrocytes) and capillaries.

HEMIPARESIS

Weakness of one side of the body, including one arm and one leg.

HEMIPLEGIA

Paralysis of one side of the body, including one arm and one leg.

IMMUNE SYSTEM

A complex network of glands, tissues, circulating cells, and processes that protect the body by identifying abnormal or foreign substances and neutralizing them.

IMMUNE-MEDIATED DISEASE

A disease in which components of the immune system — t cells, antibodies, and others — are responsible for the disease either directly (as occurs in autoimmunity) or indirectly (for example, when damage to the body occurs secondary to an immune assault on a foreign antigen such as a bacteria or virus).

INTERFERON

A group of immune system proteins, produced and released by cells infected by a virus, which inhibit viral multiplication and modify the body's immune response.

INTERFERON GAMMA

A naturally-occurring substance in the body, produced primarily by activated T cells, which promotes inflammation and is thought to be involved in MS exacerbations. Once tried as a treatment for MS, it was found to make the disease worse. Interferon beta works to counteract the effects of interferon gamma.

MOTOR NEURONS

Nerve cells of the brain and spinal cord that enable movement of various parts of the body.

MYELIN

A soft, white coating of nerve fibers in the central nervous — in MS, nerve fiber conduction is faulty or absent. Impaired bodily functions or altered sensations associated with those demyelinated nerve fibers are identified as symptoms of MS in various parts of the body.

NERVOUS SYSTEM

Includes all of the neural structures in the body: the central nervous system consists of the brain, spinal cord, and optic nerves; the peripheral nervous system consists of the nerve roots, nerve plexi, and nerves throughout the body.

NEUROGENIC BLADDER

Bladder dysfunction associated with neurologic malfunction in the spinal cord and characterized by a failure to empty, failure to store, or a combination of the two. Symptoms that result from these three types of dysfunction include urinary urgency, frequency, hesitancy, nocturia, and incontinence.

NEURON

The basic nerve cell of the nervous system. A neuron consists of a nucleus within a cell body and one or more processes (extensions) called dendrites and axons.

OLIGOCLONAL BANDS

A diagnostic sign indicating abnormal levels of certain antibodies in the cerebrospinal fluid; seen in approximately 90 percent of people with multiple sclerosis, but not specific to MS.

OLIGODENDROCYTE

A type of cell in the central nervous system that is responsible for making and supporting myelin.

OPTIC DISC

The small blind spot on the surface of the retina where cells of the retina converge to form the optic nerve; the only part of the retina that is insensitive to light.

PARAPARESIS

A weakness but not total paralysis of the lower extremities (legs).

PARAPLEGIA

Paralysis of both lower extremities (legs).

PARESIS

Partial or incomplete paralysis of a part of the body.

PARESTHESIA

A spontaneously occurring sensation of burning, prickling, tingling, or creeping on the skin that may or may not be associated with any physical findings on neurologic examination.

PAROXYSMAL SPASM

A sudden, uncontrolled limb contraction that occurs intermittently, lasts for a few moments, and then subsides.

PAROXYSMAL SYMPTOM

Any one of several symptoms that have sudden onset, apparently in response to some kind of movement or sensory stimulation, last for a few moments, and then subside. Paroxysmal symptoms tend to occur frequently in those individuals who have them, and follow a similar pattern from one episode to the next.

PERIVENTRICULAR REGION

The area surrounding the four fluid-filled cavities within the brain. MS plaques are commonly found within this region.

PLANTAR REFLEX

A reflex response obtained by drawing a pointed object along the outer border of the sole of the foot from the heel to the little toe. The normal flexor response is a bunching and downward movement of the toes. An upward movement of the big toe is called an extensor response, or Babinski reflex, which is a sensitive indicator of disease in the brain or spinal cord.

PYRAMIDAL TRACTS

Motor nerve pathways in the brain and spinal cord that connect nerve cells in the brain to the motor cells located in the cranial, thoracic, and lumbar parts of the spinal cord. Damage to these tracts causes spastic paralysis or weakness.

QUADRIPLEGIA

The paralysis of both arms and both legs.

REFLEX

An involuntary response of the nervous system to a stimulus, such as the stretch reflex, which is elicited by tapping a tendon with a reflex hammer, resulting in a contraction. Increased, diminished, or absent reflexes can be indicative of neurologic damage, including MS, and are therefore tested as part of the standard neurologic exam.

REHABILITATION

Rehabilitation in MS involves the intermittent or ongoing use of multidisciplinary strategies (e.g. physiatry, physical therapy, occupational therapy, speech therapy) to promote functional independence, prevent unnecessary complications, and enhance overall quality of life. It is an active process directed toward helping the person recover and/or maintain the highest possible level of functioning and realize his or her optimal physical, mental, and social potential given any limitations that exist. Rehabilitation is also an interactive, ongoing process of education and enablement in which people with MS and their care partners are active participants rather than passive recipients.

REMYELINATION

The repair of damaged myelin. Myelin repair occurs spontaneously in MS but very slowly. Research is currently underway to find a way to speed the healing process.

ROMBERG'S SIGN

The inability to maintain balance in a standing position with feet and legs drawn together and eyes closed.

SUPPRESSOR T-LYMPHOCYTES

White blood cells that act as part of the immune system and may be in short supply during an MS exacerbation.

T-CELL

A lymphocyte (white blood cell) that develops in the bone marrow, matures in the thymus, and works as part of the immune system in the body.

TANDEM GAIT

A test of balance and coordination that involves alternately placing the heel of one foot directly against the toes of the other foot.

VERTIGO

A dizzying sensation of the environment spinning, often accompanied by nausea and vomiting.

VIBRATION SENSE

The ability to feel vibrations against various parts of the body. Vibration sense is tested (with a tuning fork) as part of the sensory portion of the neurologic exam.

WHITE MATTER

The part of the brain that contains myelinated nerve fibers and appears white, in contrast to the cortex of the brain, which contains nerve cell bodies and appears gray.

NO. 9

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NO. 10

Medication List (by usage)

DISEASE MODIFYING MEDICATIONS USED OFF-LABEL IN MS

(*See pp.35 for information about the FDA-approved disease modifying therapies in MS)*

Category	Purpose	Medication	General Nursing Considerations
Blood product	Pooled human immunoglobulin G (IgG) that is presumed to modulate the immune system.	Intravenous Immunoglobulin (IVIG) Available from 5 manufacturers: Baxter — Gammagard, Liquid-Gammagard, S/D Polygam Talecris — Gamunex Grifols — Flebogamma Octapharma — Octagam CSL Behring — Carimune NF, Privigen	It has been suggested that intravenous immunoglobulin (IVIG) administered for five consecutive days during the first week postpartum, and at six and twelve weeks thereafter, may help prevent postpartum relapses. May be used for relapse management in some situations. Patients should receive product from one manufacturer only as changes in brands can increase reactions.

Chemotherapy	Immunosuppressant	cyclophosphamide (Cytoxan)	Literature documents IV treatment of 4 successive days with high doses in patients refractive to standard treatments. Side effects: hair loss, nausea, bladder injury, and risk of infection. Long-term side effects include sterility, mutations, and the increased risk of bladder cancer, lymph node or bone marrow.
Chemotherapy	Immunosuppressant	azothiaprine (Imuran)	Side effects: severe anemia or leucopenia, liver damage, and cancers such as leukemia or lymphoma.
Chemotherapy	Immunosuppressant	methotrexate	Prescribed as a once weekly oral dose. Side effects include skin reactions, lung infections, diarrhea, liver problems, kidney failure, bone marrow suppression. Not to be taken with NSAIDs.

ACUTE TREATMENT OF EXACERBATIONS

Category	Purpose	Medication	General Nursing Considerations
Corticosteroid	Used to treat relapses, optic neuritis and as pulse therapy	methylprednisolone (Solu-Medrol) dexamethesone (Decadron)	Methylprednisolone dose is typically 500 mg to 1 gram IV daily for 1–5 days. May be prescribed on routine basis (e.g., monthly, quarterly) as a way to manage disease progression when response to other medications is suboptimal. This is known as pulse therapy. Short term side effects include: upset stomach, dizziness, changes in menstrual period, headache, difficulty sleeping, increased appetite, weight gain, fluid retention, mood changes (euphoria, mania, depression or agitation) increased risk of infection, changes in vision, increased thirst, hyperglycemia, stomach pain, joint or bone pain, rapid heartbeat, delayed wound healing, increased risk of infection, puffy face, weight gain, tendon ache, or swelling in the feet or ankles, menstrual irregularities.

			Potential long term risks include: osteopenia, osteoporosis, avascular necrosis, stomach ulcers, weight gain, acne, cataracts and diabetes. Patients who receive steroids should wait at least several weeks to months before receiving the full vaccine benefit. Corticosteroids are not recommended in women who are breastfeeding as it can slow infant growth. Corticosteroids are used cautiously in pregnant women during a relapse if the benefits outweigh potential fetal risk.
Purified Hormone	Management of relapse	adrenocorticotropic hormone (ACTH) (H.P. Acthar Gel)	ACTH is administered via intramuscular injection. Dose is typically 80 units per day for a week followed by a tapering schedule over a second week. Side effects include mood and sleep changes, nausea, increased appetite, weight gain, fluid retention, hypertension, increased thirst, menstrual irregularities.

Category	Purpose	Medication	General Nursing Considerations
GABA antagonists	Muscle relaxant	Baclofen (Lioresal) oral Intrathecal Baclofen (ITB) therapy	Side effects include dry mouth, transient drowsiness, daytime sedation, dizziness weakness, headache and fatigue. Abrupt discontinuation of this medication (oral or intrathecal can result in seizures, hallucinations, increased muscles spasms and restlessness. Symptoms of overdose include drowsiness, lightheadedness, sudden onset of blurred vision, shortness of breath or trouble breathing, vomiting, constipation, seizures, loss of consciousness, coma. Once pump inserted after trial period, dose titration can be a slow process to minimize risk of weakness as well as other side effects. It is important for patients to attend all pump refill appointments. Pump failures can lead to under-dosing or over-dosing.

Agonists	Anti-spasticity	tizanidine (Zanaflex)	Side effects include: dry mouth, somnolence/sedation, asthenia (weakness, fatigue and/or tiredness), dizziness, constipation, abdominal pain, headache, mood changes.
Benzodiazepines	Anti-spasticity	diazepam (Valium) clonazepam (Klonopin)	Avoid alcohol as it will increase effects, patients should not discontinue abruptly as the potential for withdrawal symptoms exists. Pregnancy category D.
Neurotoxin	Muscle-relaxing agent which blocks the release of acetylcholine in the nerve endings	onabotulinumtoxin A (Botox) abobotulinumtoxin A (Dysport) rimabotulinumtoxin B (Myobloc)	Administered through injections. Doses of each brand are not equivalent. Side effects include: weakness in the muscles that were injected, pain at injection site, muscle soreness that affects their whole body, difficulty swallowing, red rash that lasts several days after the injections.

Potassium channel blocker	Improve ambulation	dalfampridine (Ampyra)	Increased risk of seizures, insomnia, back pain, dizziness, fatigue, burning and tingling or itching of skin, irritation to nose or throat, indigestion, constipation, pain in throat, balance disorder, urinary tract infections, falls. This medication should not be prescribed to patients with a known seizure risk or disorder.

FATIGUE

Category	Purpose	Medication	General Nursing Considerations
Antiviral	Fatigue management	amantadine (Symmetrel)	Effect unknown. Works in some patients. Typically first line management. Side effects: hallucinations, nausea, hyperactivity, anxiety, insomnia, and constipation.

CNS Stimulants	Fatigue management	modafinil (Provigil) armodafinil (Nuvigil) methylpheidate (Ritalin, Ritalin-SR)	Side effects include: headache, stomach pain, loss of appetite, insomnia, nervousness, dizziness, vomiting, irritability, blurred vision, muscle stiffness, tingling, burning or back pain. Patients should not discontinue medications abruptly Women on medication for birth control such as birth control pills or implants, may not be effective while taking modafinil or for one month after taking modafinil. Additional birth control forms are suggested.
SSRIs	Fatigue Management	fluoxetine (Prozac) sertraline (Zoloft) fluvoxamine (Luvox) paroxetine (Paxil) citalopram (Celexa) escitalopram (Lexapro)	Side effects include: insomnia, rashes, headaches, joint and muscle pain, stomach upset, nausea, or diarrhea, sexual dysfunction: diminished sexual interest, desire, performance, and or satisfaction. Bleeding problems with SSRis and NSAIDs exist. Monitor for serotonin syndrome especially after initiation or dose changes or if patient on triptans for migraines.

Category	Purpose	Medication	General Nursing Considerations
SSNRI	Antidepressant	duloxetine (Cymbalta) venlafaxine (Effexor)	Monitor for serotonin syndrome especially after initiation or dose changes or if patient on triptans for migraines.
SSRI	Antidepressant	fluoxetine (Prozac) sertraline (Zoloft) fluvoxamine (Luvox) paroxetine (Paxil) citalopram (Celexa) escitalopram (Lexapro)	Side effects include: insomnia, rashes, headaches, joint and muscle pain, stomach upset, nausea, or diarrhea, sexual dysfunction: diminished sexual interest, desire, performance, and or satisfaction. Bleeding problems with SSRIs and NSAIDs exist. Monitor for serotonin syndrome especially after initiation or dose changes or if patient on triptans for migraines.

Tricyclic	Antidepressant	Amitriptyline (Elavil) Imipramine (Tofranil) Desipramine (Norpramine) Nortriptyline (Pamelor)	Side effects include: Drowsiness, dry mouth, blurred vision, constipation, urinary retention, dizziness, impaired sexual functioning, increased heart rate, disorientation or confusion, headache, low blood pressure, sensitivity to sunlight, increased appetite, weight gain, nausea, weakness.
Uncategorized		bupropion (Wellbutrin) mirtazepine (Remeron)	Side effects include: worsening depression/other psychiatric conditions, unusual behavior changes (including possible suicidal thoughts/attempts), or other mental/mood changes (including new/worsening anxiety, panic attacks, trouble sleeping, irritability, hostile/angry feelings, impulsive actions, severe restlessness, very rapid speech). Suicide risk is much higher in MS patients compared to the general population.

Uncompetitive NMDA receptor antagonist and sigma-1 agonist + CYP450 2D6 inhibitor	Pseudobulbar affect (uncontrolled episodes of laughing and/or crying)	dextromethorphan + quinidine (Nuedexta)	Thrombocytopenia or other hypersensitivity reactions: Discontinue if occurs. (5.1) ■ Hepatitis: Discontinue if occurs. (5.2) ■ QT Prolongation: Monitor ECG if concomitant use of drugs that prolong ■ QT interval cannot be avoided or if concomitant CYP3A4 inhibitors used. (5.3). ■ Left ventricular hypertrophy (LVH) or left ventricular dysfunction (LVD): Monitor ECG in patients with LVH or LVD (5.3). CYP2D6 substrate: Nuedexta inhibits CYP2D6. Accumulation of parent drug and/or failure of metabolite formation may decrease safety and/or efficacy of concomitant CYP2D6 metabolized drugs. Adjust dose of CYP2D6 substrate or use alternative treatment when clinically indicated. (5.4, 12.4)

			■ Dizziness: Take precautions to reduce falls. (5.5) ■ Serotonin syndrome: Use of Nuedexta with selective serotonin reuptake inhibitor (SSRI)'s or tricyclic antidepressants increases the risk. ■ Discontinue if occurs. (5.6, 7.4) ■ Anticholinergic effects of quinidine: Monitor for worsening in myasthenia gravis and other sensitive conditions. (5.7)

Category	Purpose	Medication	General Nursing Considerations
Antiepileptics	Antiepileptics	carbamazepine (Tegretol; Carbatrol — extended release) gabapentin (Neurontin) pregabalin (Lyrica) lamotragine (Lamictal) levetiracetam (Keppra) oxcarbazepine (Trileptal) tiagabine (Gabitril) topiramate (Topamax) zonisamide (Zonegran)	Doses may be increased over time. Side effects include dry mouth, constipation, decreased taste, dizziness, ataxia, nausea, fatigue, tremor, Patients receiving carbamazepine should be monitored for hyponatremia.
Nonsteroidal Anti-inflammatories (NSAIDs)	Nociceptive pain	(selective representation) ibuprofen (Motrin; Advil) aproxyn sodium (Naprosyn; Aleve) elecoxib (Celebrex) aspirin (ASA)	Side effects may include heartburn, constipation, diarrhea, abdominal pain, bloating, gastrointestinal bleeding, bruising

SNRI Antidepressants	Chronic neurogenic pain	duloxetine (Cymbalta) venlafaxine (Effexor)	Difficulty sleeping blurred vision; decreased sexual desire or ability; dizziness; driving may be impaired; dry mouth; flushing; headache; increased sweating; nausea; mood changes; vomiting; weakness; weight gain or loss. Initial doing is low and titrated over time. Monitor for serotonin syndrome especially after initiation or dose changes or if patient on triptans for migraines.
Tricyclic Antidepressants	Chronic neurogenic pain	amitriptyline (Elavil) imipramine (Tofranil) desipramine (Norpramine) nortriptyline (Pamelor)	Side effects include: Drowsiness, dry mouth, blurred vision, constipation, urinary retention, dizziness, impaired sexual functioning, increased heart rate, disorientation or confusion, headache, low blood pressure, sensitivity to sunlight, increased appetite, weight gain, nausea, weakness. Effects may not be noticed for several weeks.

SLEEP

Category	Purpose	Medication	General Nursing Considerations
hypnotics	Insomnia and or severe daytime fatigue	zolpidem (Ambien, Ambien CR) eszopiclone (Lunesta)	Must be able to devote 7–8 hours to sleep upon taking medication. Patients can experience memory problems if they wake up too soon. Side effects include: Dizziness; drowsiness (including daytime drowsiness); "drugged" feeling; dry mouth; headache; muscle aches; nausea; nose or throat irritation; sluggishness; stomach upset; weakness. These medications should not be used on a regular basis as dependence occurs.

BOWEL DYSFUNCTION

Category	Purpose	Medication	General Nursing Considerations
Bulk Forming Agents	Use of constipated or with loose stool	psyllium hydrophilic mucilloid (Metamucil) methylcellulose (Citrucel)	Can worsen gastrointestinal symptoms. May cause severe constipation and bloating if not followed with fluids. Encourage patients to develop bowel program: include diet with adequate fiber, increase activity, and activity and establish regular evacuation time.

Osmotic laxative	Constipation	polyethylene glycol-electrolyte solution (MiraLax)	May take several days for movement to occur.
Stool softeners	Constipation	ducusate (Colace) lactulose (Duphalac)	May cause diarrhea with excessive doses.
Fecal softeners	Constipation	glycerin suppositories	May cause pain with insertion. Patients should be instructed to squeeze and contract muscles within 5 minutes after inserting suppositories.
		sodium phosphate (Fleet Enema) (Fleet Enema Mineral)	May cause discomfort and cramping after fluid is released into rectum. Should work within several minutes. If no fluid or stool is released, then a patient may have to be digitally disimpacted if any discomfort occurs.

ERECTILE DYSFUNCTION

Category	Purpose	Medication	General Nursing Considerations
phosphodiesterases	Enhance erection	sildenafil (Viagra) vardenafil (Levitra) tadalafil (Cialis)	Side effects: Flushing; headache; nasal congestion; stomach discomfort after meals; chest discomfort, diarrhea, abnormal vision sudden decrease or loss of hearing; bladder pain; cloudy or bloody urine; dizziness; increased frequency of urination; painful urination.

Prostaglandin	Enhance erection	Alprostadil (Prostin VR — injection; (MUSE — suppository)	Side effects include: scarring at injection site, penile pain, priapism.

BLADDER DYSFUNCTION

Category	Purpose	Medication	General Nursing Considerations
Antimuscarinic	Relax the detrusor (bladder) muscle to improve storage	darifenacin (Enablex) fesoterodine fumarate (Toviaz) oxybutynin (Ditropan, Ditropan XL) oxybutynin chloride 10% gel (Gelnique) oxybutynin transdermal system (Oxytrol) solifenacin fuccinate (Vesicare) tolterodine (Detrol, Detrol LA) trospium chloride (Sanctura, Sanctura XR)	Side effects include dry mouth, blurred vision, flushing, palpitations, nausea, constipation, confusion, drowsiness headache, and urinary retention. Not safe or unconfirmed safety in pregnancy. Contra-indicated in pts with uncontrolled narrow-angle glaucoma, gastric or urinary retention or obstruction, ulcerative colitis, myasthenia gravis and severe heart disease; caution in pts with renal or hepatic impairment. Compli-ance is limited due to side effects. Higher than recommended doses of antimuscarinics may be prescribed for patients with neurogenic dysfunction, which can result in increased side effects. More than 1 agent may be used simultaneously.

			Antimuscarinics delivered in topical forms also have side effect of site reactions. Oxybutynin can also be delivered intravesically (into bladder). Typically reserved for patients with intolerance to other antimuscarinics and have indwelling catheters or perform ISC.
Alpha-adrenergic blocker	Can relax smooth muscle of the prostate and /or bladder neck to bladder improve emptying in men and women	doxazosin (Cardura) tamulosin (Flomax) terazosin (Hytrin)	Postural hypotension, headache dizziness, tachycardia, rhinitis, infection, abnormal ejaculation, asthenia, back pain, diarrhea, pharyngitis, chest pain, cough, somnolence, nausea, insomnia, priapism, decreased libido.
Antidiuretic hormone	Prevention of nocturia to enhance sleep quality and quantity	desmopressin acetate (DDAVP)	Can be prescribed as a nasal spray or oral medication. Should be taken at bedtime with no repeat dosing in a 24 our period. May cause hyponatremia. Other side effects include: allergic reactions, nausea, vomiting, weakness, loss of appetite, headache, restlessness, irritability, hallucinations, muscle pain, weakness, seizure, shortness of breath, runny nose, itchy water eyes, hot or cold feelings.

Anti-infectives	Urinary tract infection (though used for other infections UTIs are experienced by many with MS and can be recurrent	ciprofloxacin hydrochloride (Cipro) nitrofurantoin (Macrodantin) sulfamethoxazole and trimethoprim (Bactrim, Bactrim DS, Septra, Septra DS, SMZ-TMP DS)	Can be taken with food or milk to lessen stomach upset and to promote the body's absorption of the medication. Finish the full course of treatment as prescribed. May cause urine to become rust-yellow or brownish — this does not require medical treatment. Side effects that should be reported to physician immediately: diarrhea, chest pain; chills; cough; fever; trouble breathing; dizziness; headache; numbness, tingling, burning of face or mouth; unusual weakness or tiredness; itching; joint pain; skin rash; yellow eyes or skin. May cause skin to become more sensitive to sunlight. Can cause changes in the blood, possibly resulting in a greater chance of certain infections, slow healing, and bleeding of the gums. Avoid antacids within 2 hours of taking medication. Antibiotics may be prescribed to prevent recurrent urinary tract infections.

Antiseptic	Suppressant for recurrent UTIs	methanamine (Hiprex, Urex)	May cause gastro-intestinal distress, contraindicated for patients with renal and liver insufficiency. Should not be taken while on antibiotics due to potential interaction.

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