Multiple sclerosis

Case #3

Janet's has experienced periodic episodes of tingling in her extremities, dizziness, and even episodes of blindness. After 12 years, doctors have finally given her a diagnosis. Follow Janet through her journey and find out why her disease is so difficult to diagnose.

Case Objectives

The following website may aid in your review of the nervous system.
Exploring the Brain and Spinal Cord It covers a wide range of topics which the interested student may want to peruse. It includes excellent graphics. Specific topics at this website that would be helpful for review are: *Brain Basics: Division of Nervous System*, *The Neuron: Types of Neurons*

1) Using an anatomy and physiology text and the links above, define the following components of the nervous system:
    a. Neuron. To include axon, dendrite, cell body, myelin sheath.
    b. Central nervous system
    c. Peripheral nervous system
    d. Define which nervous system is affected by multiple sclerosis.
2) Describe the function of a myelin sheath. Describe how multiple sclerosis affects the myelin sheath.
3) Define multiple sclerosis. Include in your definition a description of Relapsing-Remitting MS, Primary-Progressive MS, Secondary-Progressive MS, and Progressive-Relapsing MS. List similarities and differences in each MS pattern.
4) List common symptoms of MS.
5) Diagnostic Testing –
    a. Define the principle behind each of the following diagnostic tests described in the case study. Describe how MS may adversely affect results of each test:
        i. Visual fields
        ii. Visual acuity
        iii. Cat scan
        iv. MRI
        v. Evoked potential
        vi. Lumbar Puncture
    b. Of the above diagnostic tests, list the 3 commonly used to diagnose MS.
    c. Describe why MS is often a difficult disease to diagnose.
6) Define common treatments for MS and their effect on the disease. Compare the treatment of MS with steroids to the treatment of MS with beta interferons.
7) Health Professionals.
    a. Describe the roles of the following health care providers in the diagnosing and care of a patient with MS: ophthalmologist, neurologist, radiologist, radiological technician, clinical laboratory scientist, and home health nurse

b. Discuss in terms of job hours, flexibility, and services provided the differences in the roles of a home health nurse from a clinical nurse working in a hospital setting.

Janet, age 22, was preparing for her 6-week postpartum checkup. Six weeks earlier, she had delivered her first son. The day of her checkup, she became very dizzy. The room was spinning, and she felt she had lost all equilibrium. She mentioned the dizziness to her doctor, who suggested an iron supplement for postpartum anemia. 2 days later the dizziness subsided and she felt fine.

At 25, in the third trimester of her second pregnancy, Janet began to have migraine headaches, something she had not experienced before. Her little finger went numb and tingly. This sensation traveled up her arm and into her face. The headaches and the numbness lasted a few days. One year later, this episode repeated itself. This time, Janet was not pregnant.

Nine years went by, symptom free. Janet was now 31. She had brushed off the previous episodes as a strange reaction to stress until she woke up one morning extremely nauseated. Not only was she nauseated but her eyes would not focus. She put her contacts in; she could see fine out of the left eye but saw double out of the right. The following day, her vision had not improved. Her husband called the ophthalmologist who agreed to see her immediately. The ophthalmologist performed a routine eye exam which included checking for changes in *visual fields* and checking *visual acuity*. Janet's exam showed a decrease in her visual acuity and her visual field in her right eye was also decreased. Her right eye showed nystagmus, involuntary rapid eye movement. The ophthalmologist referred Janet to a neurologist for further testing.

1) *What is a visual field?*
2) *What conditions may affect the visual field of the eye?*
3) *What is a visual acuity test?*
4) *Why is a visual acuity test performed?*

The neurologist told Janet that he suspected she was showing initial symptoms of *multiple sclerosis* (ms). He ordered a computerized tomography or *CT scan* of the brain to look for characteristic plaques. No plaques were evident and the neurologist could not make a definitive diagnosis. By this point, Janet was regaining her normal vision. The attack had lasted four days.

Instructor's Note: At the time Janet had this testing done, a CT scan was the most sophisticated imaging technique available. Magnetic Resonance Imaging (MRI scan), a more sophisticated imaging technique, did not yet exist!

5) *What happens to the myelin sheath of the nerve in MS?*
6) *Why does this occur?*
7) *How does this affect a patient with MS?*
8) *What functions may be affected by MS?*
9) *What happens to the nerve after an assault on the myelin sheath?*
10) *What is the most common pattern of MS attacks?*
11) *How much time may occur between relapses in RR-MS?*
12) *What is the difference between primary progressive MS (PP-MS) and relapsing remitting (RR-MS)?*
13) *50% of patients with RR-MS progress to what form of MS?*
14) *What type of MS is characterized by frequent attacks and a steady decline in ability?*
15) *What symptoms are suggestive of MS?*
16) *Describe what a CT scan is.*

Three years later, at 34, Janet awoke to a prickly tingling feeling from her waist down to her feet. The sensation of "pins and needles" was so intense, she could hardly walk. She made another appointment with a neurologist who ordered three tests to confirm his suspicion of multiple sclerosis. These tests consisted of a lumbar puncture, evoked potential testing, and a scan of her brain and spinal column by a new exciting imaging technique, *magnetic resonance imaging*.

17) *How does an MRI scan differ from a CT scan?*
18) *What are the advantages of an MRI scan over a CT scan?*

The first test, a *lumbar puncture*, checked for elevated protein levels in the cerebral spinal fluid (CSF). Results showed an increased level of abnormal protein.

19) *What is a lumbar puncture?*

Evoked potential testing showed definite slowing of nerve impulses.

Instructor's Note: Because nerve signals cannot easily pass through demylinated nerves, nerve impulses are slower than normal. This slowing of the nerve impulses is what is detected through the evoked potential test.

MRI Results

20) *What causes the characteristic plaques seen in MS?*
21) *Why are the plaques not always seen in a patient with MS?*

The neurologist made a diagnosis of multiple sclerosis based on the MRI, Evoked Potential, and CSF protein results. The diagnosis was made 12 years after Janet's initial symptoms.

Instructor's Note: Multiple Sclerosis is a very difficult disease to diagnose. Plaques are usually not evident for many years, and in some cases may never be seen. Physicians often make a "probable diagnosis" of MS based on the patients symptoms.

Janet was put on a high dose of prednisone, a steroid used to reduce inflammation, thus reducing plaque formation. A home health nurse administered SOLU-MEDROL (methylprednisolone) by I.V. This drug is a synthetic steroid that suppresses acute and chronic inflammation.

Janet was relatively symptom free for the next 8 years. Another exacerbation (attack) at this point left Janet unable to move without the use of a wheelchair or walker. This attack lasted several weeks. During this time, a home health care nurse visited Janet daily performing many services including helping her bathe, massaging muscles and administering medications. At this point, her physician recommended changing her medication to *Avonex,* a beta interferon. The doctor explained that this medication could slow the progression of demylination by up to 40%. The Avonex was administered once a week by injection by the home health nurse. Although Janet's motor skills improved after the attack, she did not fully recover. Janet can walk, but does so with a stiff and awkward gait. She has severe muscle tremors but is still able to function quite normally. Her hope is that the new interferon medications will slow the exacerbations so that she can maintain the level of activity she now enjoys.

22) *How do steroids differ from B-interferons in the treatment of MS? See (Multiple Sclerosis-treatment).*

Case Summary

Instructor's Note: *Because of the long time span involved in this case, it is summarized here in table format.*

Age	Symptoms	Diagnostic Testing	Doctor's Conclusions
22	Dizzy, loss of equilibrium	None	Anemia
25	Headaches, tingling, and numbness	Did not consult a doctor	N/A
26	Headaches, tingling, and numbness	Did not consult a doctor	N/A
31	Nauseated, double vision	Visual acuity, Visual fields, CAT scan	Probable multiple sclerosis
34	Intense tingling and numbness from waist down	Lumbar puncture, Evoked Potentials, MRI	Confirmed multiple sclerosis

1) Multiple sclerosis (MS) is an autoimmune disease in which the body's immune system attacks the myelin sheath surrounding the nerves in the central nervous system. Although some of the myelin may be repaired after an attack, myelin may also disappear and characteristic scarring may form (plaques). Demyelination of the nerves slow or may actually stop nerve impulses.

2) The alteration of nerve impulses may cause varied symptoms. Janet's symptoms included fatigue, dizziness, visual blurring, and sensory disturbances including tingling and numbness. As Janet's disease progressed, her motor skills became impaired causing partial paralysis and leaving her with an awkward, shuffling gait. In advanced multiple sclerosis, symptoms may included bladder dysfunction and mental impairment.

3) MS can be a difficult disease to diagnose. Characteristic plaques may not appear until the disease has progressed for some time. The diagnosis is based upon the patient's history and symptoms, elevated proteins in the CSF, slowing of nerve impulses detected by evoked potentials, and MRI results showing lesions or plaques in the spinal cord, brain stem, and/or cerebral cortex.

4) Steroids or anti-inflammatory drugs are used to shorten the duration of acute attacks. Beta interferons such as Avonex are used to suppress the body's immune response to decrease the attack against myelin. Supportive therapy for individual symptoms is given as needed.

5) There is no known cure for Multiple Sclerosis. The average duration of the disease is 30 years.

6) There is no known prevention for Multiple Sclerosis. Research supports the theory that there is a genetic predisposition to MS which is triggered by an environmental factor such as a virus.

7) A person with MS may see varied health professionals depending upon their symptoms. In Janet's case, her ophthalmologist first suspected MS and referred her to a neurologist who made the diagnosis. Several key health professionals performed the diagnostic testing crucial for diagnosis. These professionals include clinical laboratory scientists who evaluated the cerebral spinal fluid, and radiological technicians who performed the cat scan and MRI. The radiologist read and interpreted both the cat scan and MRI. Nursing care, in this case, was provided by a home health care nurse. These nurses provide services to individuals in their homes, often to the elderly and those that are homebound. In this case, a home health care nurse assisted Janet during the severe attack that left her unable to walk. Later, the nurse visited weekly to administer medications. The home health link describes requirements for this field as a bachelors degree in nursing. This is required for certification but it should be noted that RN's and LPN's also work as home health nurses.

Answers to Case Questions

Question 1
The total area seen by an eye when fixed on a central point.

Question 2
CNS tumors, diabetes, hyperthyroidism, hyper-tension, multiple sclerosis.

Question 3
Measuring the smallest line read on an eye chart when standing at a predetermined distance.

Question 4
To detect changes in vision.

Question 5
The myelin sheath is attacked and eventually destroyed.

Question 6
The body's immune response may attack the myelin sheath in response to a virus.

Question 7
Nerves are damaged causing interference in functions controlled by the nervous system.

Question 8
Vision, speech, walking, writing, memory.

Question 9
Some of the myelin may be repaired but some may disappear. Scarring may occur. Material deposited into the scars forms plaques.

Question 10
Relapsing-remitting (RR-MS) which is a series of attacks followed by a partial or complete disappearance of symptoms.

Question 11
Weeks to decades.

Question 12
PP-MS there is a gradual decline in abilities with only short periods of slight relief. In RR-MS there is long asymptomatic periods with brief periods of relapse.

Question 13
Primary progressive MS.

Question 14
Progressive relapsing MS.

Question 15
Visual disturbances, muscle weakness, spasms, fatigue, numbness, and prickling pain or sensation in extremities.

Question 16
A large donut-shaped x-ray machine takes x-ray images at many different angles around the body. These images are processed by a computer to produce cross-sectional pictures of the body. In each of these pictures the body is seen as an x-ray "slice" of the body, which is recorded on a film. This recorded image is called a tomogram. "Computerized Axial Tomography" refers to the recorded tomogram "sections" at different levels of the body.

Question 17
An MRI scan uses magnetism, radio waves, and a computer to produce images of body structures. A CT scan uses a series of x-rays.

Question 18
An MRI scan produces much greater detail than a CT scan.

Question 19
Insertion of a needle into the spinal canal to withdraw cerebrospinal fluid (CSF) for testing.

Question 20
The plaques are caused by areas of demyelination in the nerves. Scar tissues is formed and material deposited in the scar tissue forming the plaques.

Question 21
It may take many years for the demyelination and the scarring process to occur. The body repairs some of the myelin following an attack.

Question 22
Steroids are used to reduce inflammation. They are nonspecific and have many side affects. B-interferons suppress the immune system, thus reducing attacks on the myelin sheath.

Health Professionals Introduced in this Case

Ophthalmologist
Physician
Radiology
Radiology Technician
Neurologist
Clinical Laboratory Scientist
Nursing
Home Health Nurse

Additional sites of Interest

MS The Disease.
http://www-medlib.med.utah.edu/kw/ms/