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.
Case Study Questions

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.

**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.
Case Study Questions

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 a nerve after an assault on the myelin sheath?
10. What is the most common pattern of MS attacks?
11. What is the difference between primary progressive and relapsing remitting MS?
12. What symptoms are suggestive of MS?
13. 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.
14. How does an MRI scan differ from a CT scan?

15. 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.
16. What is a lumbar puncture?
Evoked potential testing showed definite slowing of nerve impulses.

**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

Arrows point to plaques or areas of demyelination
Case Questions

17. What causes the characteristic plaques seen in MS?

18. Why are the plaques not always seen in patients 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.

**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 demyelination 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.
19. How do steroids differ from B-interferons in treatment of MS?
## Summary

<table>
<thead>
<tr>
<th>Age</th>
<th>Symptoms</th>
<th>Diagnostic Testing</th>
<th>Doctor's Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Dizzy, loss of equilibrium</td>
<td>none</td>
<td>Anemia</td>
</tr>
<tr>
<td>25</td>
<td>Headaches, tingling, and numbness</td>
<td>Did not consult doctor</td>
<td>N/A</td>
</tr>
<tr>
<td>26</td>
<td>Headaches, tingling, and numbness</td>
<td>Did not consult doctor</td>
<td>N/A</td>
</tr>
<tr>
<td>31</td>
<td>Nauseated, double vision</td>
<td>Visual acuity, Visual fields, CAT scan</td>
<td>Probable multiple sclerosis</td>
</tr>
<tr>
<td>34</td>
<td>Intense tingling and numbness from waist down</td>
<td>Lumbar puncture, Evoked Potentials MRI</td>
<td>Confirmed multiple sclerosis</td>
</tr>
</tbody>
</table>
Health Professionals Introduced in this Case

- Ophthalmologist
- Physician
- Radiology
- Radiology technician
- Neurologist
- Clinical laboratory scientist
- Nursing
- Home health nurse
Computerized (or computed) tomography, and often formerly referred to as computerized axial tomography (CAT) scan, is an X-ray procedure that combines many X-ray images with the aid of a computer to generate cross-sectional views and, if needed, three-dimensional images of the internal organs and structures of the body. Computerized tomography is more commonly known by its abbreviated names, CT scan or CAT scan. A CT scan is used to define normal and abnormal structures in the body and/or assist in procedures by helping to accurately guide the placement of instruments or treatments.
An MRI (or magnetic resonance imaging) scan is a radiology technique that uses magnetism, radio waves, and a computer to produce images of body structures. The MRI scanner is a tube surrounded by a giant circular magnet. The patient is placed on a moveable bed that is inserted into the magnet. The magnet creates a strong magnetic field that aligns the protons of hydrogen atoms, which are then exposed to a beam of radio waves. This spins the various protons of the body, and they produce a faint signal that is detected by the receiver portion of the MRI scanner. The receiver information is processed by a computer, and an image is produced.
Lumbar Puncture

A lumbar puncture (an LP) is the insertion of a needle into the fluid within the spinal canal. It is termed a "lumbar puncture" because the needle goes into the lumbar portion (the "small") of the back.

Other names for a lumbar puncture (an LP) include spinal tap, spinal puncture, thecal puncture, and rachiocentesis.

An LP is most commonly performed to diagnose a disease, namely to obtain a sample of the fluid in the spinal canal (the cerebrospinal fluid) for examination. It can also be used to treat diseases by administering antibiotics, cancer drugs, or anesthetic agents into the spinal canal.

The patient is typically lying down sideways for the procedure. Less often, the procedure is performed while the patient is sitting up. LPs in infants are often done upright.

After local anesthesia is injected into the small of the back (the lumbar area), a needle is inserted in between the nearby vertebrae into the spinal canal. The needle is usually placed between the 3rd and 4th lumbar vertebrae.
Evoked Potentials

An **evoked potentials test** records the time it takes for a sensory stimulus, such as a light flashed into the eyes, to reach the brain. The test can check the brain's response to visual, auditory, and pain stimuli. Electrodes are simply attached to the scalp, connecting the individual to an electroencephalograph (EEG), a device that records brain waves.
Beta Interferon

The interferon beta medicines resemble the natural interferon the body produces during a response by the immune system to disease. It is not completely clear how interferon beta medicines work in people with multiple sclerosis (MS). But it is known that they affect the immune system and also help fight viral infections. They also work by preventing inflammation and demyelination in the central nervous system.

The interferon beta medicines also limit the activity of gamma interferon, which is a protein produced by the immune system that makes MS worse.