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**DISC HERNIATION OR DEGENERATIVE
DISC DISEASE**

BY: ROBERT M. ADOCHIO, ESQ.

INTERVERTEBRAL DISC

The Intervertebral Disc is the connective tissue between two vertebral bodies. It is attached to the hyaline [smooth shiny cartilage] end plates on the adjacent surfaces of the vertebral bodies. The Disc consists of an annulus fibrosis and a nucleus pulposus. One may analogize the disc to a jelly donut with the jelly being the nucleus pulposus and the surrounding dough the annulus fibrosis. The disc serves as a pad or a shock absorber between the solid vertebral bodies. Each disc, together with the vertebra above and below, forms a joint which allows for movement in the spinal column.

The consistency of the nucleus pulposus has been compared to that of toothpaste and its purpose is to lend elasticity to the vertebral column. In the cervical spine the nucleus is located just forward of the disc center. In the lumbar spine, the nucleus is more centrally located within the disc. The cervical spine moves in a gliding fashion while the lumbar spinal movement is a rocking motion of one vertebrae on another. The location of the nucleus anteriorly within the disc and the presence of thick ligaments covering the posterior surfaces of the vertebrae and disc, reduces the incidence of posterior herniations in the cervical spine. At birth the nucleus pulposus is jell-like and made up of approximately 88% water. From birth to old age a gradual desiccation (or loss of water) occurs. The content will decrease to approximately 70% in old age. In addition the annulus fibrosis will lose water from approximately 78% to about 70%, however this is less important than the water content of the nucleus pulposus.¹ Mechanically, the water content of a disc is important as it impacts the ability of the disc to handle stresses and compressions. As the nucleus pulposus dries out, it has a diminished ability to imbibe water and therefore becomes less resistant to external traumas and stresses.² The healthy disc is like a sponge filled with water. When the spine bends under loads the disc will compress and facilitate movement. As the load eases, the disc will regain its normal shape and re-absorb the water lost in compression. This ability to imbibe water decreases with the aging process.

There is some nerve supply in the disc, however the main source of nerve endings lie in the tissues which attach the posterior longitudinal ligament to the annulus of the disc. Those nerves are more likely to become pathological in the central disc herniation but not in the more common lateral disc herniation.³

Generally, each successive lower disc is larger than the one above it. In thickness, the discs vary in different portions of the spine. In the cervical and lumbar areas they are thicker anteriorly or towards the front of the body than they are posteriorly or towards the back which contributes to maintaining the lordotic curves in these areas. In the thoracic spine, they are approximately uniform in height. Kyphosis in the area is maintained by the vertebral bodies which are thicker posteriorly than anteriorly.⁴ The annulus fibrosis bulges slightly beyond the adjacent vertebral bodies. The anterior and posterior longitudinal ligaments are inserted into it.

The spinal cord runs from, and is continuous with, the under surface of the brain. It lies within the vertebral canal and is surrounded and protected by the vertebrae. In the average adult, the spinal cord is slender and cylindrical, approximately 26 inches in length and 5/8 of an inch in width. There are 31 pairs of spinal nerves that leave the spinal cord and service the various organs, tissues and muscles of the body. As the spinal nerve roots pass through the intervertebral foramina they lie to the rear and the sides of the Intervertebral Disc. This is where any bulging, protrusion or herniation of the disc may touch or compress on the nerve roots.

¹ Lumbar Discectomy and Laminectomy (R. Watkins and J. Collis, Jr. ed. 1987)

² Spine. Lumbar Disc Disease, (R. Guyer, M.D. ed. Jan. 1989).

³ Orthopaedic Practice (P.M. Yoeman and D.M. Spengler ed. 1996)

⁴ L. Gelfand, LL.B., R. Magana, LL.B. and R.R. Merliss, M.D., Courtroom Medicine-The Low Back. Vol. 1 (Dec. 1990).

THE DEGENERATIVE PROCESS

Degeneration of an Intervertebral Disc merely is the loss of water in the disc. The human spine degenerates mostly with age and degeneration does not cause clinical symptoms or disc disease per se. Disc Degeneration starts in males after the first decade and in females after the second decade. The greatest increase in degeneration rate has been found to occur between 25 and 35 years of age.⁵ Generally the patients with disc herniation have more pronounced disc degeneration. The most common cause of disc degeneration is thought to be mechanical and related to loads on and trauma to the discs. Certainly torsional stresses in daily activities further play a major role in disc degeneration.

It is important to note that a degenerated disc is not a herniated disc. A degenerated disc and degenerative disc disease is a normal part of the aging process. Certainly a degenerative disc can lose its elasticity causing the disc space to be diminished and can lead to contact with the nerve roots and can cause pain. Therefore it is important that a complete medical history of your client be taken and the presence of prior spinal pain, prior treatments or trauma must be fully explored. Some literature suggests that by the third decade of life a disc reaches its full development and there after it begins to degenerate. These changes lead to a decrease in functionality of the disc to absorb stress and maintain flexibility in the spine. Therefore, a degenerated disc may pre-dispose the client to a greater risk of a herniation or pain producing injury in an otherwise unpainful condition. In the first state of disc degeneration the disc involved becomes unstable and the movement of the related vertebrae becomes uneven.

As a result of this instability that portion of the spine becomes vulnerable to stress and trauma. A loss of disc space is indicative of degenerated disc and this can be seen on x-ray. In addition the sagittal views on MRI show very clearly a desiccated or degenerated disc as the normal discs will appear white and the desiccated disc will appear black or shadowed. Osteophytes or bones spurs develop where two of the bony prominences or the bony areas of the vertebrae come into contact. The presence of Osteophytes can also be the end result of a disc that has been damaged by trauma. Disc degeneration can be without symptoms. However, neck pain, shoulder pain, suboccipital pain, headaches, pain between the shoulders or pain down the arm or into the chest all may be related to disc degeneration. In the lumbar spine disc degeneration may cause low back pain and radicular pain especially along the sciatic nerve. One should note that the proximity of the x-ray and/or MRI film to the trauma is key in determining whether a finding is preexisting. Certainly an x-ray or MRI taken within one or two months of the trauma which indicates a degenerative disc would indicate that the condition was pre-existing.

Degenerative discs have the following characteristics:

- Decreased disc height;
- Increased lateral bulging;
- A reduced ability to retain water; and
- Increased mobility.

Decreased disc height leads to abnormal loading of the facet joint [The joints of the vertebral column]:

Lateral bulging can produce nerve root compression;

Reduced internal pressure causes an increase in end plate loading;

Increased mobility produces greater stresses on adjacent soft structures.

⁵ Spine, Lumbar Disc Disease (R. Guyer, M.D. ed. Jan. 1989).

Degenerative disc disease therefore is a syndrome initiated by degenerative changes in the disc which then involves other spinal elements that contribute to the symptom complex.⁶ In the early stages of disc degeneration the annulus fibrosis fibrillates and develops central cracks that extend toward the periphery. A specific traumatic event which often involves bending or twisting may lead to herniation of the nucleus. Continued desiccation and fibrosis make herniation less frequent in the elderly.⁷ Some features of degenerative disc disease seen on x-rays are the narrowing of the disc space, reduction in the lordosis, sclerosis [hardening] and narrowing of the facet joints in osteophyte formation. Further the presence of a schmorl node, which is a small disc herniation through the end plate, is further evidence of degenerative disc disease.

Segmental instability and spinal stenosis are two other indications of the end stage of degenerative disc disease. When the disc thins the ligaments attached thereto become lax and may allow for instability. The excessive disc space narrowing allows for friction of the vertebrae. In addition to osteophytes, this friction may also cause vertebrae hypertrophy which is an abnormal enlargement. The forward slippage of one vertebrae over another may be caused by this segmental instability. This is known as spondylolisthesis. Degenerative spondylolisthesis is especially common at the L4-L5 disc space. In a spinal stenosis in the low back the degenerative disease usually results in a person who is more comfortable sitting, with the spine flexed, than standing or walking. This is a reversal of the picture seen with acute disc herniation.⁸

Degenerative changes, as indicated above, generally occur slowly and do not produce pain symptoms. Many clients are surprised to learn of these findings on x-ray because of the absence of any symptoms prior to trauma.

Other degenerative disorders which serve to cloud diagnoses of spinal pain include:

Osteoarthritis, also called degenerative or hypertrophic arthritis commonly seen in the older client. This condition is evidenced by degeneration of the cartilage which covers the surface of bone in the posterior apophyseal joints. Back motion is painful and eventually secondary disc space narrowing may occur. Clients will generally experience a history of low back pain without sciatica. Neurological tests will be normal. The bony changes will be seen on x-ray.

Rheumatoid Spondylitis - This is a progressive form of chronic arthritis that results in fusion of the affected vertebrae and a deformity of the spine. Symptoms include early morning pain and stiffness.

Osteoporosis - A metabolic bone disease marked by loss of calcium from bone which causes bone softening. Affecting older persons, the disease is readily apparent on X-ray. Back pain and gradual weakening of the bony structures can cause pressure on the nerve roots making it difficult to distinguish osteoporosis from disc protrusion.

Spondylolisthesis - a forward displacement or slipping of a vertebrae on the one below it. This condition can be seen on x-ray and most frequently affects the L5 and S1 vertebrae. If there is a sciatic pain, a possible disc herniation should be considered in clients with this condition.

Spina Bifida Occulta - a congenital defect marked by incomplete ossification of the vertebral spinous process and lamina. This condition is usually asymptomatic.

⁶ F. Wilson and P. Lin, General Orthopaedics (1977).

⁷ F. Wilson and P. Lin, General Orthopaedics (1977).

⁸ F. Wilson and P. Lin, General Orthopedics, (1977).

Transitional vertebrae - usually a sacralization of the 5th lumbar vertebra (forming a false joint with the pelvis) or a lumbarization of the first sacral vertebra (where the first segment of the sacrum detaches from the second segment and creates a continuation of the lumbar spine). These situations create abnormal spinal movement and mechanics and can predispose the client to disc problems.⁹

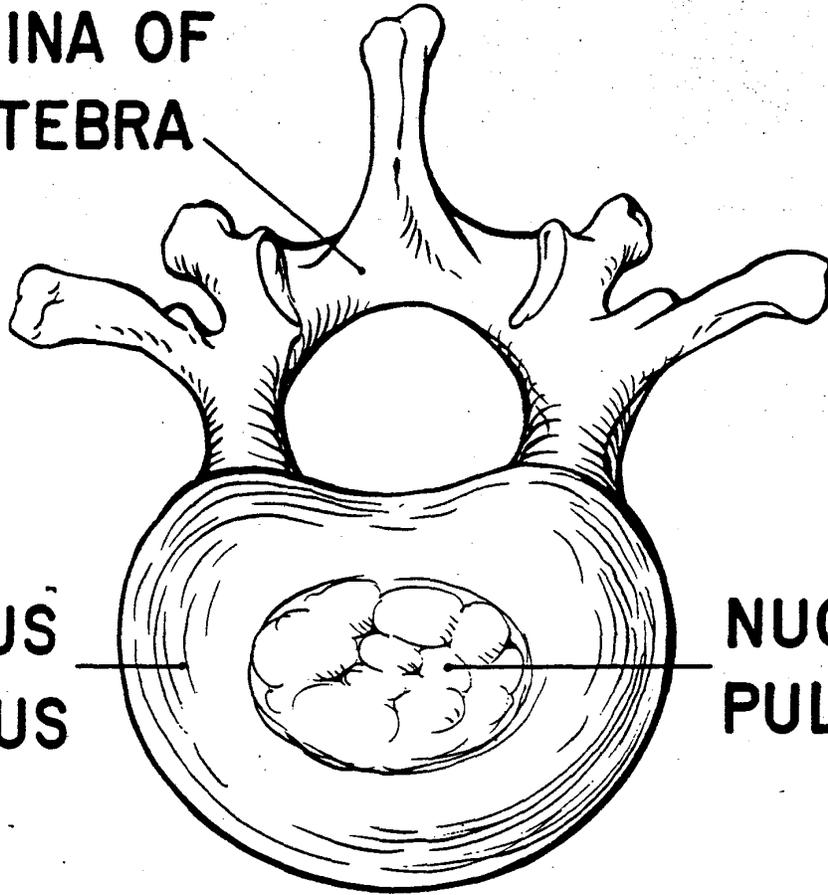
⁹ R. Gray, M.D. and L.J. Gordy, M.D. LL.B., *Attorney's Textbook of Medicine*, (3rd ed. 1992).

THE INTERVERTEBRAL DISC

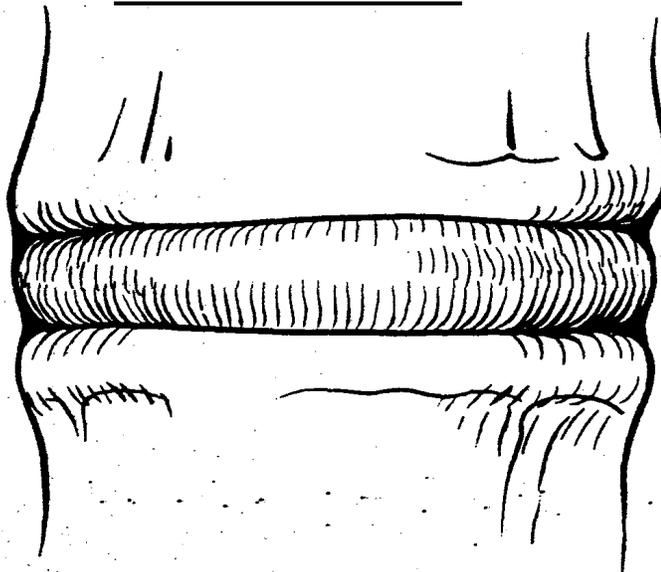
LAMINA OF
VERTEBRA

ANNULUS
FIBROSUS

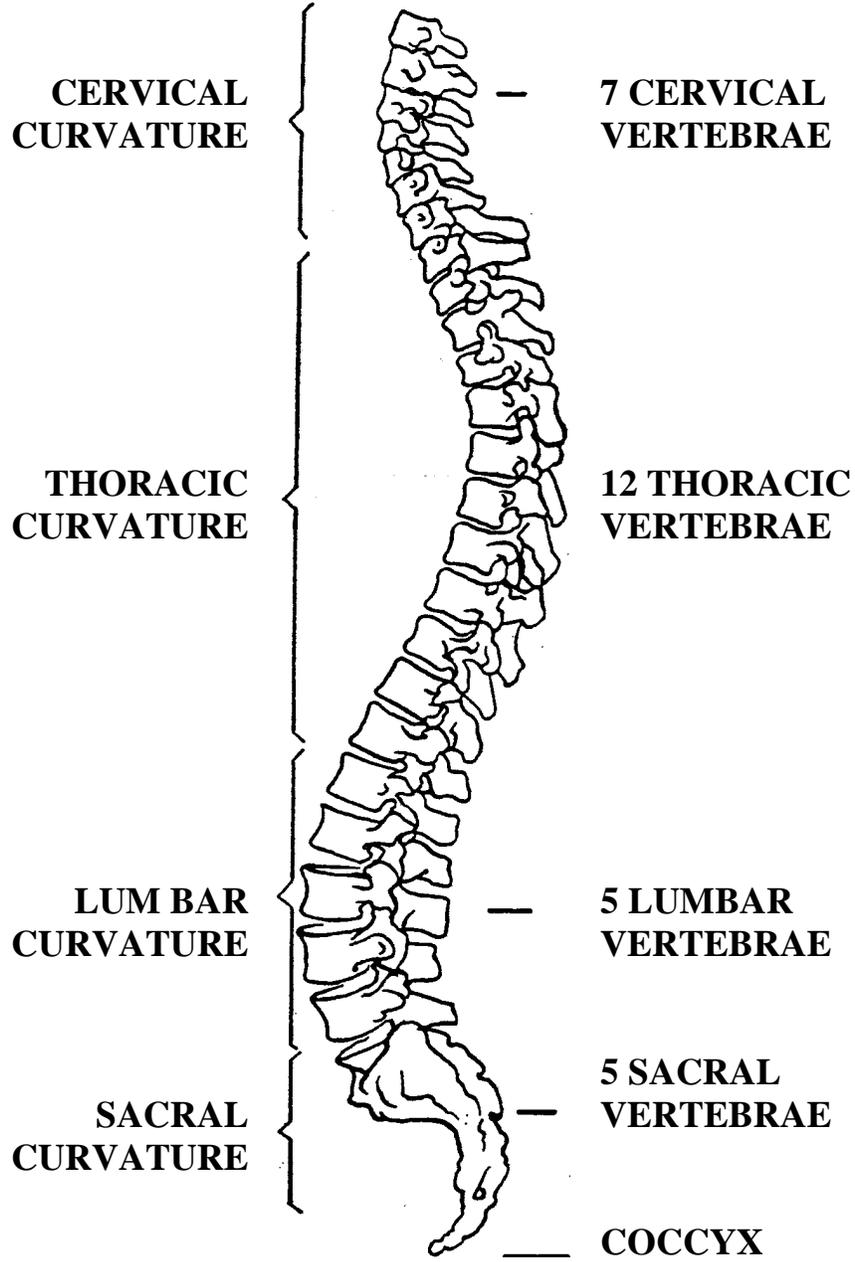
NUCLEUS
PULPOSUS



SUPERIOR VIEW



ANTERIOR VIEW





Low back x-ray demonstrating a narrow disc space at the L4-5 level - The L5-S1 level is a normal disc space.

THE HERNIATED LUMBAR DISC

In medical literature, the terms protruded disc and herniated disc are frequently used interchangeably. Nerve root compression results when herniated disc material presses into the intervertebral foramen. The extent of the pain and disability will depend on the size of the nerve root canal and on the degree to which the disc material is impinging in the space. In addition, whether a motor function is affected or a sensory deficit is noted depends on which of the nerve roots is being affected. Frequently because of the variations in the nerve root compression, low back pain, in lumbar disc herniations, will be intermittent.

Most disc herniations occur in the lumbar and cervical spine rarely in the thoracic spine. Approximately three quarters of all disc herniations arise in the lumbar area with the L4-L5 and L5-S1 disc spaces most frequently affected. In the neck, the C5-C6 and C6-C7 discs account for over 90% of all cervical disc herniations.¹⁰

The types of trauma or events which commonly cause lumbar disc herniation include a hyperextension injury which may occur from a rear end motor vehicle accident or in an attempt to regain ones balance after slipping. Torsional type injuries may occur when the client is exerting while the trunk is twisted or turned and when the client is lifting a heavy object. Head-on automobile collisions will lead to a flexion injury where a disc will compress anteriorly or towards the front of the body. A fall where the client lands in an upright position may lead to a herniated disc as well. In addition, any compression type injury while the spine is bent could cause a sudden rupture of the disc. In acute herniated disc cases, the client would often experience a sharp shooting pain in the low back. The pain would often radiate into the lower leg often causing the client to experience a tingling or burning sensation known as paresthesia. Additionally, any prolonged sitting will aggravate symptoms. Even coughing, sneezing and bowel movement will increase the pain. Symptoms of low back herniated disc include a persistent low back pain; an acute incapacitating pain which will be intermittent in severity and in latter stages include pain along the sciatic nerve. The client may also experience numbness or tingling in the lower extremities.

It is not uncommon for the client to have only minimal complaints of discomfort even when MRI or other diagnostic test shows a sizable disc herniation provided the nerve root canal is large enough to accommodate the nerve without compressing it. Further, the opposite may also be true, where even a small herniation may produce debilitating symptoms if the nerve canal is small and there is compression from the herniation. Indeed, the client may experience symptoms at a different nerve root level than where the herniation appears on MRI due to migration of pieces of the disc material.

It is extremely important for the doctor, upon the initial interview, to make a "differential diagnosis." This is where the doctor attempts to "differentiate" among the possible causes of low back pain. If there is a suspected herniated disc, the doctor should attempt to locate the level at which herniation may have occurred. This differential diagnosis is extremely important for the physician and requires a series of questions to the client designed to elicit the physical history, the pain history and the history of injury to the client. The defense examiner will have to concede that this history is important in determining a diagnosis. The examiner must also concede that the client is probably being truthful and accurate in providing this information in an effort to cure his or her injuries and that the treating doctor usually relies upon this information. The history should include the client's main complaint, his medical history, and that of his family and the client's work and social history. Furthermore, the history should include any prior hospitalizations, surgeries, back injuries, allergies or medication which the client is taking. The treating doctor will be attempting to eliminate illnesses such as diabetes, gout, kidney disease, rheumatic disease, enlarged prostate gland, anemia, venereal disease, cardiovascular problems or chronic intestinal problems as a cause for low back discomfort. Likewise, the age of the client, his intake of alcohol, caffeine and tobacco which may be associated with osteoporosis is important. The client will also be asked about recreational activities and his or her occupation to determine whether there is any predisposition to low back problems.

¹⁰ R. Gray, M.D. and L. J. Gordy, M.D., LL.B., Attorneys' Textbook of Medicine, (3rd ed. 1992).

Type, nature and location of back pain is extremely important to the examiner as any pain which is felt in the lower extremity should strongly suggest nerve root involvement. It is further important to pay particular attention to the events leading to the injury during the taking of the client's history and the position of the client at the time of the injury and the type of forces applied to the back.

The physical examination conducted both by the treating physician and the defense examining physician should include those tests as listed in the appendage to this article. Whole body dynamics should be observed by the physician when conducting the examination. Signs of spinal pathology and, more particularly, herniated disc and/or nerve root irritation include an abnormal or absent spinal curve, any listing to one side, or a painful heel and toe walking. Additionally, the physician should look for a "protective scoliosis" which may be triggered by muscle spasms, any limping, and pain produced by attempting to bend backwards. It is important to note that these individual tests are sometimes more significant for what they may rule out rather than what they may prove. Orthopedic tests, however; may have inherent deficiencies in that the examiner is unable to determine in any quantitative way how much effort the client is putting into the test. There is little data available to indicate any deviations from a normal expected test result. Further, the interpretation of the test results can be subjective and vary among NC doctors. When reviewing the medical condition and records of the client, the attorney should be aware that no one test is clearly dispositive of a pathology. Rather, the client must be viewed in relation to his or her entire clinical picture to determine the appropriate diagnosis.

It is important to keep in mind that the spinal nerves are each formed by two nerve roots which branch out from the spinal cord and through the neural foramina. Motor impulses are carried through the nerve roots which leave the spinal cord and travel to the anterior or front of the body and sensory perceptions are carried by the nerve roots which lie in the posterior or back of the body. Therefore, the absence of a motor impulse such as a diminished patellar reflex should not be interpreted as the absence of disc herniation at the L3-L4 level but rather the herniation may be impinging on the sensory nerve rather than a motor nerve. Impingement on anterior nerve roots which carry motor impulses will result in alterations in reflexes, a paralysis or partial paralysis with muscle weakness. Root compressions on sensory nerves will cause pain, anesthesia (which is a loss of the sense of pain and touch), a hypesthesia (which is a diminished sense of pain and touch) or a paraesthesia (which is a prickling or tingling sensation). In other words, the absence of a reflex change does not necessarily mean the absence of a herniated disc. However the presence of a reflex change helps to clinically con-elate disc herniation.

The patellar reflex is generally indicative of a disc involvement at the L3-L4 disc space. The Achilles tendon reflex or ankle jerk, is used to detect deficiencies in the L5-S1 and S2 nerve roots. When this reflex is affected, the foot will go into plantar flexion where the foot bends at the ankle so that the toes move away from the shin. This is, again, indicative of an L5-S1 problem. The defense examiner must concede that if the herniated disc is in the L3-L4 area that an absent Achilles tendon or ankle jerk reflex is not a relevant finding. Conversely, where the disc herniation in question is in the L5-S1 intervertebral space a negative patella reflex or knee jerk test is likewise irrelevant. A hyperactive Achilles reflex indicates that the patient is experiencing a mild irritation. A diminished or absent reflex indicates a severe and prolonged compression.

In regards to sensory changes in the low back, generally an L5 S1 disc herniation will cause a diminution in the sensation along the posterior, or rear, lateral calf, the lateral foot and the 5th toe. A herniation at the L4-L5 level will affect sensation on the top surface of the foot and the big toe. However, it should be noted that there may be overlapping innervation, anatomical variations and differences in the location of the disc herniation which may tend to confuse the findings for the treating physician.

DIAGNOSTIC TESTING

X-RAYS

X-rays, as previously stated, do not picture the soft tissue structures with any degree of accuracy. In addition, the nucleus pulposa is not picked up on x-ray and this test will not confirm disc herniation nor show a nerve root entrapment. X-rays will however, show any disc pathology which may be demonstrated by a disc space narrowing or changes in the alignment of the vertebrae and it will show the onset of schmori's nodes.

MYLOGRAMS

Mylograms are limited in that they can only depict a posterior lateral herniation. They use high dosages radiation and cause adverse reactions, more particularly headache, stiffness, nausea and vomiting.

CT SCANS

CT Scans also use fairly high radiation dosages. Often CT's are excellent in showing the extent of the disc herniation.

MRI

These tests are non-invasive and do not utilize radiation. Trial attorneys should be intimately familiar with these exams. The MRI, however, may sometimes over estimate disc pathology. They sometimes are not accurate in delineating bone and osteophytes, although, as previously noted, they are excellent in differentiating normal discs from desiccated discs. One draw back is that an MRI will sometimes not show a disc injury when in fact one has occurred due to the lapse in time between damage to the disc material and the subsequent loss of water. There has also been criticism because of its inability to show the discs in a weight bearing situation.

ELECTROMYOGRAPHY

This test is used for studying and recording electrical impulses arising in nerves associated with muscle movement. However, it is only an indirect method of evaluating nerve function along the path from the spinal cord to the muscles, since muscle movement in itself does not produce electrical activity, and the abnormality in electrical activities sometimes may not be pin pointed by utilizing this test. The test results must be con-elated with clinical findings. Further, several other factors may compromise EMG findings, such as external electrical interference in the examining room or adjacent thereto, temperature changes, drug use of the client and the skill of the examiner. In addition, since there is a normal lag of time between an injury and the denervation of a muscle there is some limitation to the EMG study. Typically, the injury requires three weeks to manifest in an EMG. Therefore this test is best conducted greater than three weeks after the trauma. In addition; it should be noted that EMG does not test sensory nerve functions, but motor nerve impulses. Therefore, a herniated disc which encroaches on a sensory nerve root would be missed by EMG.

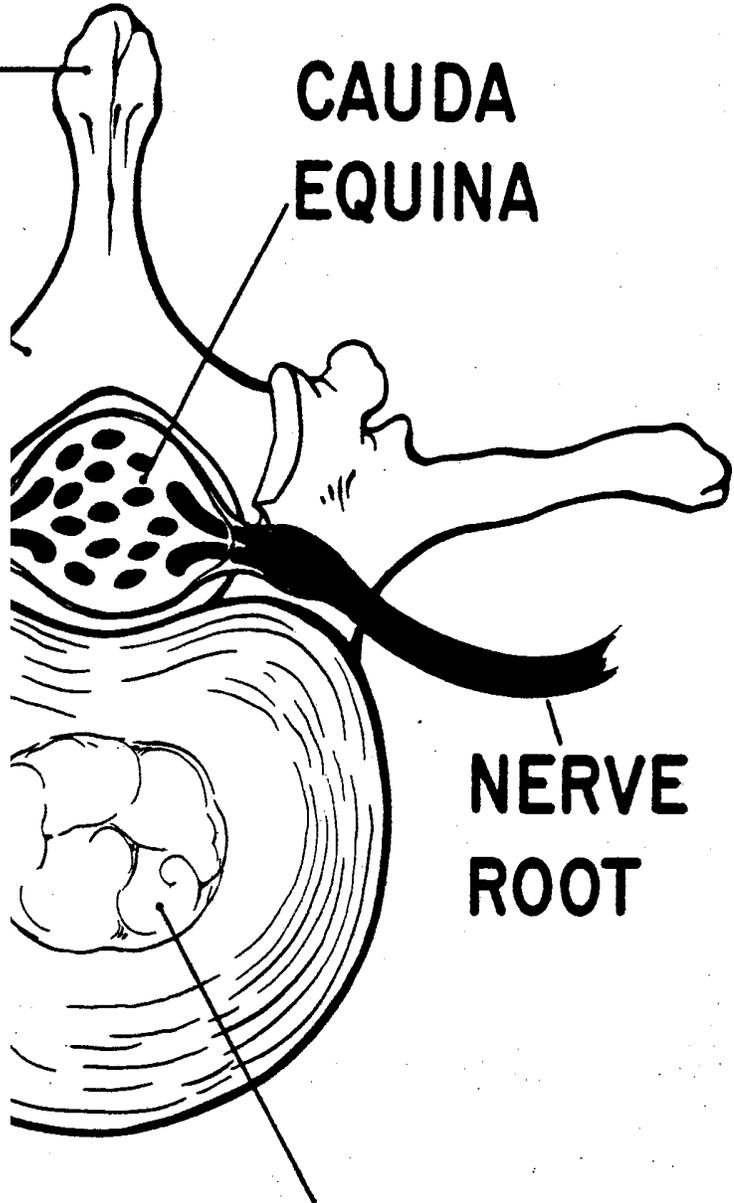
LUMBAR SPINAL NERVE ROOTS (SUPERIOR VIEW)

**SPINOUS
PROCESS**

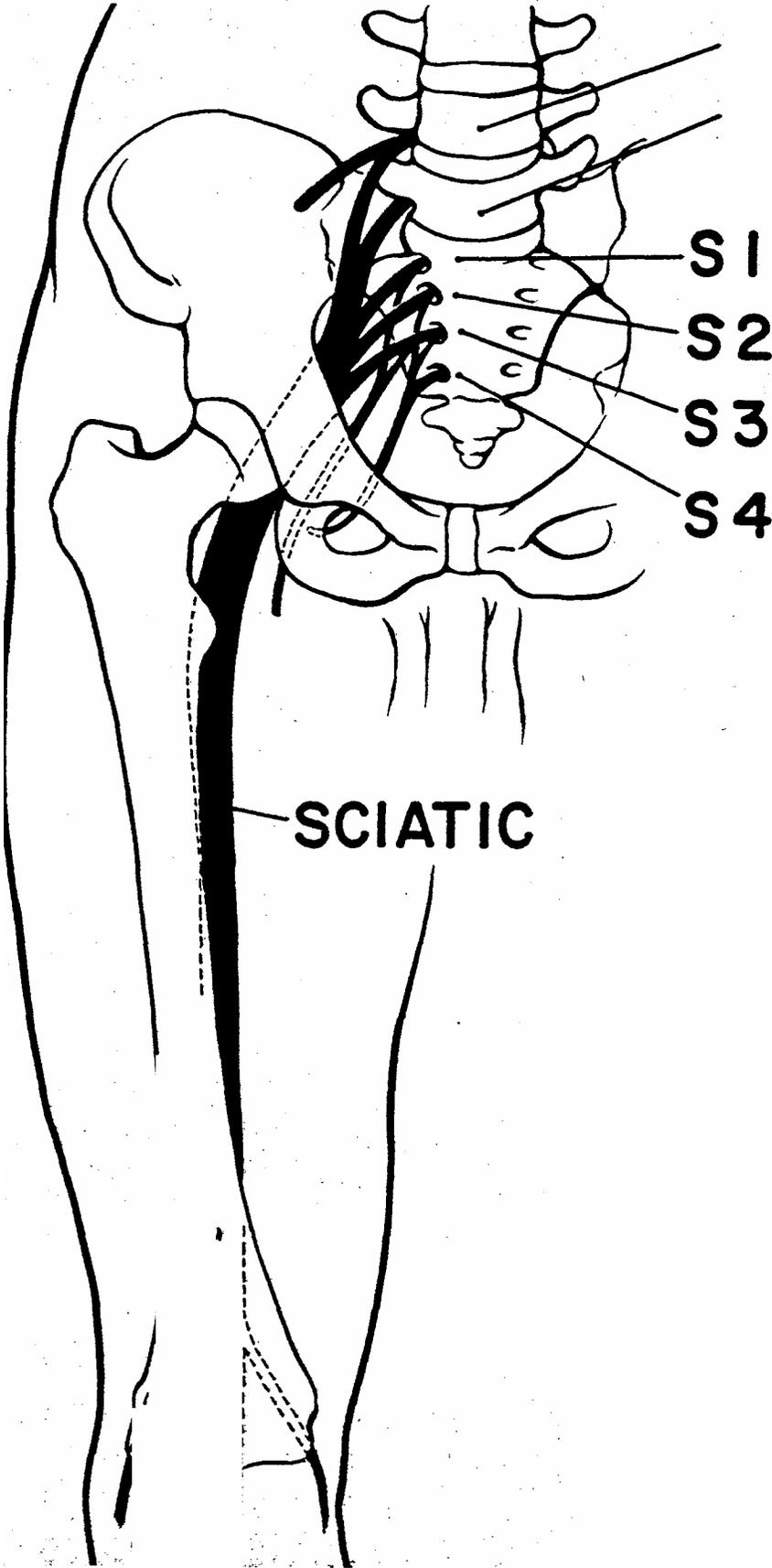
LAMINA

**CAUDA
EQUINA**

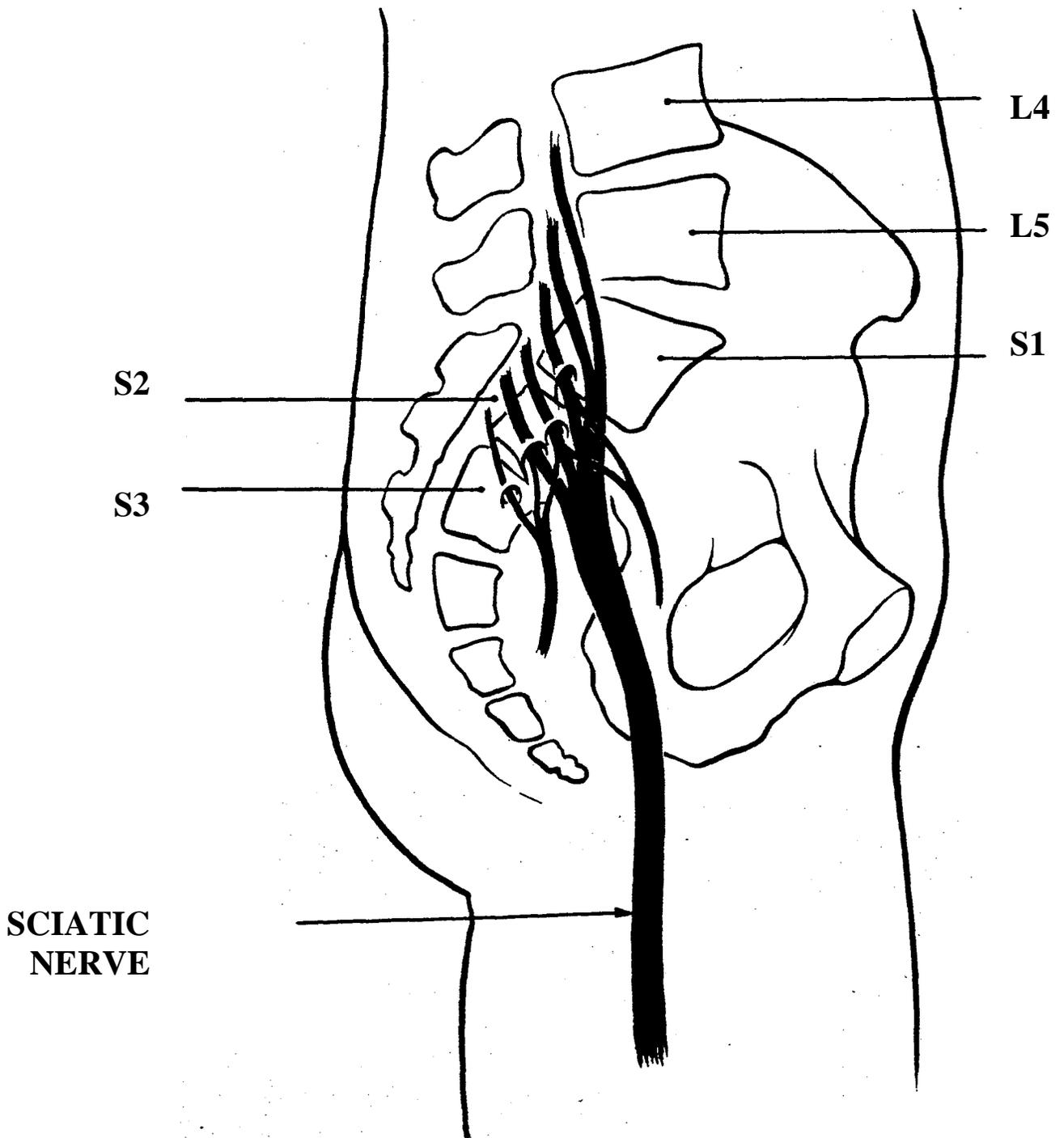
**NERVE
ROOT**



SCIATIC NERVE ORIGINS



SCIATIC NERVE ORIGINS (SIDE VIEW)



HERNIATED CERVICAL DISC

Cervical discs differ from lumbar discs in several ways:

The discs are smaller than the lumbar discs and are less likely to herniate. The spinal cord however, is larger in the lumbar area and provides less room for nerve root movement. Accordingly, in a herniation in the cervical spine nerve root compression is more likely to occur. In addition, herniations in the cervical spine are more likely to compress the spinal cord itself. The great majority of cervical herniations occur in the C5-C6 and the C6-C7 spaces. This is where the cervical spine has its greatest flexibility.

Disc degeneration will occur in the cervical spine as it does in the lumbar spine. In the cervical spine however, the presence of a Schmorl's node is often accompanied by the formation of osteophytes. When the nodes are calcified they will be visible on x-ray. The presence of these nodes in the cervical spine may cause symptoms such as mild recurrent neck pain which would develop slowly. Lateral disc herniations in the cervical spine usually produce symptoms which are consistent with the compression of the nerve root. The symptoms may appear acutely or they may develop slowly. They may be intermittent and vary in intensity. The pain will usually involve one of the arms and is made worse by movement, coughing, sneezing or straining. Physical exam will reveal tenderness in the areas of the neck, shoulder and the bundle of nerves known as the brachial plexus which is located in the neck and the armpit which is supplied by the impinged nerve root. Further evidence of lateral disc herniation in the cervical spine would include reversal or straightening of the normal cervical curve, a sensory loss or diminishment regarding the involved dermatome and decreased reflexes of the tendons. The Client may experience motor weakness and twitching and the pain will be aggravated upon backward or lateral bending of the head.

A central or mid-line disc herniation in the cervical spine will usually affect and compress on the anterior or frontal surface of the spinal cord. The symptoms usually shown are neurological in nature. The upper extremities may show only mild or no symptomatology. However, nerve compression can produce a flaccid paralysis with some atrophy.

A posterolateral herniation will usually lead to compression of one side of the spinal cord and the posterior roots of the spinal nerves. Symptoms include pain and stiffness of the neck and pain or weakness of the arms.

The treating physician must reach a differential diagnosis for cervical injuries because pain symptoms can mimic many other conditions in the cervical spine.

X-rays are frequently negative in the cervical spine in the case of early disc herniation that have not yet caused narrowing of the disc space. X-rays are also useful in obtaining a differential diagnosis in order to rule out fractures or dislocations in the cervical spine. Ct-scans are often less effective in the cervical spine due to the anatomical differences. However, MRI is well suited for examining the cervical spine. The T1-T2 weighted sagittal (from the side) images are very good in MRI to differentiate disc herniation, disc space narrowing, and the formation of osteophytes and other abnormalities.

SUMMARY

You, the Trial Attorney, are the key ingredient in neutralizing the defense examiner at trial. You must be completely familiar with spinal anatomy and more particularly that of your clients. You must marshal the pertinent facts regarding your client's history, injury and its resultant impact and integrate them into your treating Doctor's testimony. Your cross-examination of the defense doctor should not proceed scattershot but should be focused in the areas where the examiner must concede information favorable to your position. Utilize learned treatises pursuant to evidence rule 703 to further your medical contentions both in cross-examination and as

substantive evidence. Avoid cross examination in medical areas of which you are unfamiliar or not prepared or you will find yourself at the mercy of an examining doctor who has been in the Courtroom more than you have.

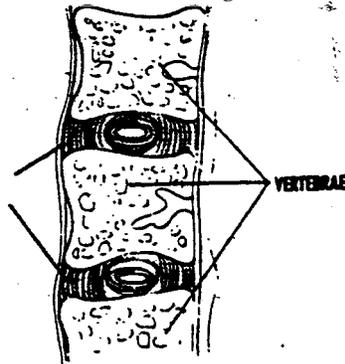
It is evident that degenerated discs and degenerative disc disease mirrors and imitates many symptoms found with a herniated disc. Age, work, social and employment histories, nature and mechanics of the impact and injury, complaints, diagnostic test results, orthopedic and neurological test results, pre-existing conditions and predispositions to injuries all must be fully explored.

As you establish your proofs, do so with an eye toward your summation. The civil jury charge requires the defendant to answer for all pain and suffering where the injury, even coupled with a silent pre-existing condition, causes pain, suffering, disability or impairment. Further, in the event of a pre-existing pathological back your client will recover damages for exacerbation and worsening of the prior conditions.

DEFINITIONS

Intervertebral Disc

One of the circular, silver-dollar-shaped pads of fibrocartilage (gristle reinforced with tough fibers) which are interposed between adjacent vertebrae. If it were not for these pads, which have a certain amount of elasticity, the spinal column or spine, composed of stacked bony blocks called vertebrae, would be a rigid, unbending structure allowing the trunk no movement sidewise, forward, or backward. The tissue of which an intervertebral is made varies in toughness from the periphery to the center, the center being the softest. In fact, a disc may be compared to a doughnut having a jelly center. Under certain conditions, as extreme pressure, the "jelly" center breaks through the surrounding ring of tough fibrocartilage, producing a herniated disc. The center of the disc, which is soft; is known as the nucleus pufposus. The surrounding tough ring is the *anulus fibrosus*. Also called *discus intervertebrails* and *intervertebral cartilage*.



Intervertebral Foramen

A foramen or opening between two adjacent vertebrae. The vertebrae are the bony "blocks" of which the spine is formed. Each of the two adjacent vertebrae contributes half of the opening, so that the two vertebrae lying against each other form a complete rounded opening. More specifically, the foramen is formed by a notch in the upper edge of one pedicle (of a vertebra) and another notch in the lower edge of the pedicle of the vertebra above. The opening allows the passage of the spinal nerve and blood vessels.

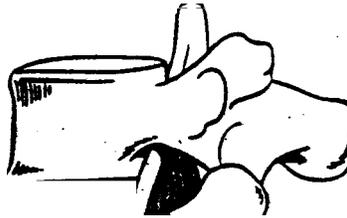
Herniation of Nucleus Pulposus

The protrusion of the tissue within an intervertebral disc through the ruptured rim of the disc, resulting in a herniated mass which may press upon the spinal cord. An intervertebral disc is a coin-shaped piece of elastic tissue (mostly gristle) which is interposed between two adjacent vertebrae, so as to allow some motion and give the spine flexibility. Such a disc is composed of a tough outer portion or rim and a relatively soft center. It may be envisioned as a jelly-filled doughnut. If such a doughnut were to be pressed between two plates of glass, it would be found that eventually the outer tough part would break and the jelly would burst out through the break. The jelly of the doughnut is the equivalent of the nucleus puiposus in the intervertebral disc. When this soft tissue breaks through the rim the intervertebral disc, the condition created is a herniation of the nucleus pulposus. One of

the causes of such herniation is extreme compression of the vertebrae, as during a fall or a jump. If the herniation is toward the canal of the spine, the herniated nucleus pulposus may press on the spinal cord, the "cable" of nerves within the canal of the spine.

Ruptured Disc

A circular pad of Fibrocartilage (gristle reinforced by tough fibers), situated between adjacent vertebrae, whose relatively soft central tissue had been pushed (by pressure) through the surrounding ring of tougher tissue. The discs situated between the vertebrae, i.e., the intervertebral discs, may be conceived as doughnuts whose centers are filled with jelly. This form of structure give the disc its pliancy or elasticity. If too much pressure is applied to such a doughnut, as between two vertebrae, the jelly breaks through the crust and the entire structure collapses. This is what happens to a ruptured disc. In such a situation the vertebrae separated by the ruptured disc come together, causing various pressures and strains. A ruptured disc is in substance a herniated disc or an advanced form of it.



Disc Protrusion

The displacement of an intervertebral disc resulting in a protrusion of part of it beyond the edges of the vertebrae. It is usually due to excessive compression.

Degeneration

A deteriorating change whereby a tissue or organ is reduced to a less functional, vital or serviceable condition. The change makes the part involved less useful. Such changes are caused by disease or injury. In some cases the cause is unknown.

Desiccate

To dry; to deprive of all moisture; to dry and shrivel.

Desiccation

1. The act of drying; the act of drying thoroughly.
2. The drying of a tissue as a means of destroying it.

Degenerative Disease

A disease which is due to a gradual loss of function on the part of important tissues, structure and organs.

Spondylolisthesis

1. A forward displacement or slipping of one of the bony segments of the spine (i.e. of a vertebra) over its fellow below, but usually the slipping of the fifth or last lumbar vertebra over the body of the sacrum. To visualize this, one may conceive the spine as a stack of coins or, better still, of tuna cans. The slipping of a coin or a can forward upon the one below represents a case of spondylolisthesis. 2. The spinal deformity produced by the slipping forward of the lumbar vertebrae so that they overhang and obstruct the pelvis; especially, such a deformity produced by the displacement of the last, i.e. , the fifth, lumbar vertebra over the top of the sacrum. Also called *spondyloptosis*.

Spondylosis

An abnormal fusion or growing together of two or more vertebrae.

Osteophyte

An outgrowth of bony tissue from a bone; an osteophym; a spur of bone.

Spur

A small, pointed outgrowth, usually of bone. Also called *calcar*.

Stenosis

The abnormal narrowing of a body passage, opening, canal, or duct.

Arthritis

1. Inflammation of a joint or joints. 2. Any disease of joints involving inflammation and tissue changes. In rheumatoid arthritis, the outstanding change consists of atrophy (wasting) and thinning of the bones involved. On the other hand, in hypertrophic arthritis, overgrowth of bone and thickening of the membranes are the outstanding changes. Arthritis may be acute, with an accompaniment of heat, redness, swelling, and pain; or it may be chronic, usually with no visible redness or swelling. In some forms of arthritis the interior of the joint is relatively dry; in others there is considerable exudation (accumulation of fluid). The causes of arthritis are varied, such as infection, injury, deficiency in the blood supply, excessive strain, etc., but in many instances the cause is unknown. One important class of arthritis is known as *degenerative* or *hypertrophic arthritis*, mentioned above. This is a chronic condition and occurs in older persons. Another great class, also mentioned above, is *rheumatoid arthritis*. This form generally begins in persons who are under the age of forty.

Lordosis

An abnormal bending or curving of the spine in which the bulge or convexity is forward. The deformity affects the lower part of the spine, in the lumbar region, at the level of the loins. The spine is normally slightly curved forward in this region; lordosis represents an exaggeration of the normal curvature.

Kyphosis

Reverse to lordosis or an abnormal bending or curving of the spine in a backward manner. Kyphosis represents a reversal of the lordotic curve.

Scoliosis

An abnormal side-to-side curvature of the spine. As seen from the back, such curvatures are usually roughly S-shaped, one curve being to the right and one to the left. It is caused by muscle and bone deformities, by unequal muscle contraction, empyema, etc.

Ankylosis

1. Stiffness or immobility of a joint; the making of a joint stiff or immovable, by operation; the fusion of a joint, as by a morbid process, and its becoming immovable. 2. The union of two or more parts to form one part.

Schmorl's Nodule

A nodule (small lump) seen in x-ray pictures of the spine, caused by the protrusion of the soft contents of a ruptured intervertebral (between vertebrae) disc.

DIAGNOSIS OF SPINAL PROBLEMS

The Physical Exam

To determine the cause of a patient's pain, a physician should obtain a complete medical history and perform a physical examination. X-rays of the affected area will be taken.

Questions that the Dr. Should Ask:

1. When did the pain first begin?
2. What is the exact location of the pain?
3. What activities make the pain worse?
4. What activities lessen the pain?
5. What daily activities does the patient participate in?
 - Hobbies
 - Sports
 - Work
 - Daily
 - Routine

The Dr. should recognize any areas of tenderness and muscle spasm, muscular weakness or atrophy and note any changes in sensation to the lower extremities. The Dr. should note posture and general physical condition and should have the patient flex, extend, and rotate the body to determine the degree of motion the patient is capable of and to identify movements that produce pain. The Dr. may also make pin pricks along the extremities and tap various muscles with a reflex hammer to test nerve function.

TESTS

Cat-Scan –

The Cat Scan (computerized axial Tomography) is a high tech x-ray procedure that is capable of photographing cross-sections of the spine. A computer interprets the information and projects it into a picture (looks similar to a regular X-ray) that the radiologist can view the various structures.

MRI –

The MRI (Magnetic resonance imaging) uses a combination of a huge superconductive magnet, electromagnetic waves, and a sophisticated computer system to create very detailed images of the body's interior. The MRI does not use radiation to make its picture. It is not stopped by dense bone and can image on the plane - vertically, horizontally, and diagonally.

Thermography -

The thermogram maps any differences in temperature on the surface of the skin. The skin is capable of dissipating excessive internal body heat through the autonomic nervous system. The concept of the thermography is based on the presumption that asymmetrical temperature patters on the skin and thus indicates pathology of the underlying soft tissue. Research shows that the surface temperature of the body is not uniform, symmetrical, or consistent at certain times and external factors can affect accuracy. Thermographic results should not be relied on as objective findings because they are not widely accepted in the medical community.

Myelogram -

A myelogram involves the injection of radio-opaque dye into the spinal column. The dye settles in the spinal column so that x-rays can outline the spinal cord and nerves. This procedure must be done in a hospital because it sometimes produces moderate to severe side effects including nausea, vomiting and headaches.

EMG -

An EMG is sometimes referred to as a nerve conduction study. It is utilized to identify nerve damage.

Ankle Jerk Reflex –

The achilles tendon is struck with a rubber hammer to test the reflex reactions related to L5-S1 nerves. The absence of a reaction is indicative of nerve entrapment.

Fabere's Sign (Patrick's Test) –

With the patient supine (lying on back, face up), the knee is flexed with the outside of the ankle resting on the knee of the opposite leg and the knee depressed. Pain would indicate arthritis in the hip.

Knee Jerk Reflex -

The tendons of the knee are struck for reflex indications of lesions at the L2-L3-L4 levels.

Laseque's Sign –

A limited ability to raise a straight leg is usually associated with lumbar nerve root compression. In addition, in sciatica, flexion of the hip is painful with the knee extended but not with the knee flexed. The physician raises the straightened leg of the patient. This puts pressure on the sciatic nerve, and pain can indicate the presence of a herniated disc.

Romberg's Sign -

Inability to maintain balance when the eyes are shut and the feet put close together. This indicates serious generalized nerve impairments.

Babinski's Sign -

The great toe extends when the sole of the foot is stroked. If the toes flex backward, it can indicate a lesion in the nervous system.

Eli's Test -

The patient lies face down while the physician raises the knee. This can suggest a herniated disc in the lower spinal column.

Percussion Testing -

This is the act of thumping on a portion of the body to determine if pain is produced as a result.

Dermatome Testing –

Sensations can be tracked along specific nerve routes. The areas that receive sensations are called dermatomes. Injury to nerves can result in strange sensations in the dermatome of that nerve or in the absence of sensation.

CT Scan (computerized transaxial tomography) –

A pinpoint X-ray beam is directed on horizontal or vertical planes of the spine. These slices are then fed into a computer, which analyzes and displays them for diagnostic purposes.

End Plates –

The end plates consist of Hyaline Cartilage which is glass like and adheres to the fibrous disc and to the nucleus pulposus and to the bone of adjacent vertebrae.

The Annulus Fibroses –

The annulus fibroses is made up of sheets of fiber. It envelops the nucleus and helps prevent structural failure.

The Nucleus Pulposus –

The nucleus pulposus is a mass of watery jelly that has no form. Because it is made up of a jelly type material and cannot be compressed. When under pressure it tends to spread out in all directions.

MODEL JURY CHARGE
6.10G (1) AGGRAVATION OF PREEXISTING ILLNESS OR
CONDITION -- GENERAL¹¹

If a plaintiff who is awarded a verdict had a preexisting illness or injury, he/she is entitled to an award of damages only if the jury finds that the illness or injury was aggravated or made more severe as a result of this accident and only to the extent of such aggravation.

In fixing your award of damages of medical and hospital expenses, loss of earnings, pain, suffering, disability and impairment, you may allow the plaintiff such damages as will fairly and reasonable compensate him/her for injuries sustained in this accident, including any additional medical and hospital expense and loss of earnings and any increased pain, suffering, disability and impairment because of aggravation of a preexisting illness or injury. You may not award damages in this lawsuit for any medical and hospital expense, loss of earnings, pain, suffering, disability or impairment attributable solely to a preexisting illness or injury.

If such preexisting illness or injury did not itself involve pain, suffering, disability or impairment, but combined with the injuries sustained in this accident to produce pain, suffering, disability or impairment, you may award damages to the full extent of such pain, suffering, disability and impairment. If you find that the plaintiff's present condition results in part from a vulnerability or predisposition or a latent disease or weakness without symptoms his/her damages would be based upon the present condition of pain, suffering, disability and impairment in full, even though you may speculate that an individual without such predisposition or latent condition would have experienced less pain, suffering, disability and impairment.

¹¹ This charge (6.10G(1)) has not been revised by the Committee, but is merely renumbered from its original 6.10G as contained in the 1973 book.

BIBLIOGRAPHY/ FOOTNOTES

1. J.E. Schmidt, M.D., Attorneys' Dictionary of Medicine, Vols. 1-5 (Feb. 1996)
2. R. Gray, M.D. and L.J. Gordy, M.D., LL.B., Attorneys' Textbook of Medicine, (3rd ed. 1992) Footnotes 9, 10
3. Civil Model Jury Charges, The New Jersey Institute for Continuing Legal Education, 3rd ed. 1990) Footnote 11
4. L. Gelfand, LL.B., R. Magana, LL.B. and R.R. Merliss, M.D., Courtroom Medicine - The Low Back, Vol. 1 (Dec. 1990) Footnote 4
5. F. Wilson and P. Lin, General Orthopaedics (1977) Footnotes 6, 7, 8
6. Lumbar Discectomy and Laminectomy (R. Watkins and J. Collis, Jr. ed. 1987) Footnote 1
7. N. Hilt and S. Cogburn, Manual of Orthopedics (1980)
8. Orthopaedic Practice (P.M. Yeoman and D.M. Spengler ed. 1996) Footnote 3
9. Spine, Lumbar Disc Disease, (R. Guyer, M.D. ed. Jan. 1989) Footnotes 2, 5
10. Trauma, Vol. 27, Num. 3 (M. Houts, J.D., R. Shafer, M.D. and N. Shafer, M.D. Oct. 1985)