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ORIENTATION TO MEDICAL ASPECTS
OF LOW BACK PAIN

JACK M. GOLDSTEIN*

A SIGNIFICANT but often unrecognized problem which attorneys encounter is the inability to make effective use of medical information and thinking pertinent in legal proceedings. Characteristically, the attorney will seek to inform himself of the facts relevant to his client's injury, and frequently he will do so with considerable effectiveness. Nevertheless, it is self-evident that he can do no more than gain a limited orientation to the medical aspects of the situation which rarely matches the depth of knowledge and sophistication which he will encounter, especially in an unfriendly medical witness. In any event, it is quite obvious that there is a direct relationship between the attorney's capacity to handle his case intelligently and effectively and the degree and accuracy of his knowledge of the relevant medical facts.

There are several ways to educate the attorney in medico-legal matters. One approach, utilized in the present article, is to orient the practicing attorney to some of the more common medical problems which are particularly troublesome in law practice. Another approach is to incorporate material into the law school curriculum, giving students adequate exposure to relevant medical problems and, more importantly, instilling in them essential medical information. This approach is in operation at the present time at the St. John's Law School in Brooklyn, New York, and will be briefly discussed later in this article.

A comprehensive review of the pathology of the back would be encyclopedic in nature. The scope of the present article will be confined, therefore, to explaining the principal relevant anatomical structural features of the back; to reviewing some of the major types of pathology, especially as related to traumatic injuries; and to outlining the appropriate examination and treatment used in each case.

Problems of the low back have long plagued the medical profession and have become a source of both medical and legal controversy. It is only in the past twenty-five to thirty years that any satisfactory classification of low back disorders has become possible. Before this time there were too many gaps in medical knowledge to permit a clear picture to be formed.

In September of 1933, Mixter and Barr (Armstrong) presented their historic paper in Boston.[1] They pointed out that cases reported as spinal cord tumors with compression of the cauda equina or nerve roots were in fact not tumors at all, but were caused by herniation of the nucleus of an intervertebral disc. They further suggested that the indicated treatment was surgical in nature. This paper was widely accepted at the time and subsequently was confirmed by surgeons all over the world. Exploration of the spinal canal in the lower lumbar region in patients suffering from intractable low back pain and sciatica found them to be suffering, in eighty percent of the cases, from so-called "disc compression."

Prior to the time of the Mixter & Barr report, the gap in knowledge concerning the "lumbago-sciatica" syndrome was too great to permit a coherent picture of the pathology, or to suggest an orderly pattern of treatment for the group of conditions responsible for low back pain, with or without sciatica. Because of the impact of that report upon the medical profession, one no longer has to spend time trying to convince others that lumbar disc lesions are at least the most common cause of both low back and sciatic pain.

This newly discovered condition, as in women's fashions, quickly became a medical fad. This phase seems to have passed, and today few physicians claim that disc lesions are the only cause of low back pain, with or without sciatica. However, the public is often at-

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1. Mixter and Barr, *Rupture of the Intervertebral Disc With Involvement of the Spinal Canal*, 211 NEW ENGLAND JOURNAL OF MEDICINE, 210-215, August 2, 1934.

tracted by a new term.   Patients who formerly took their lumbago or fibrositis for granted (and in relative silence) now gossip with some pride of their "slipped disc," whether one is present or not.
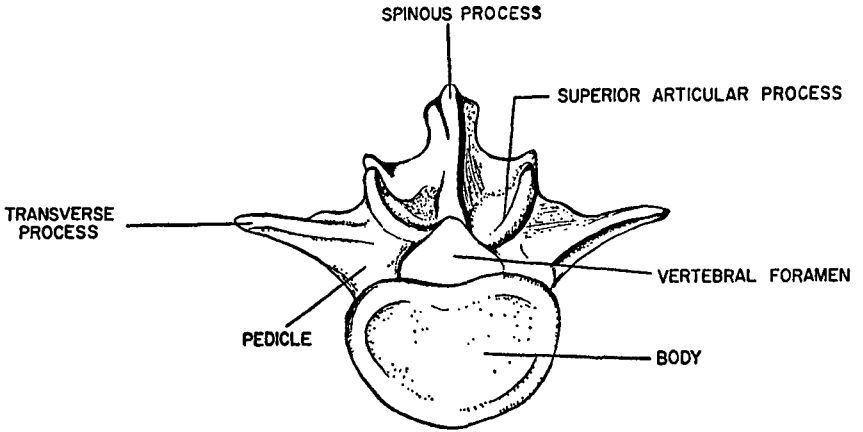
It is nevertheless true that low back pain in all probability causes more general discomfort than any other medical problem except the common cold.   It is estimated generally that annually, approximately 500,000 workers in the United States incur low back injuries while at work, for which they take time off from their jobs and receive financial compensation.[2]   Many of these individuals are incapacitated for longer periods than workers who have suffered more visibly serious injuries, such as fractured limbs or severe lacerations.   Thus, in terms of time lost from work and compensation payments, low back pain is probably one of the nation's costliest symptoms.   In spite of this huge prevalence of known cases, the available statistics for industrial accidents no doubt reveal only a part of the picture since an uncounted host of housewives and white collar workers may not even report this type of symptom.

The objective medical findings in many types of low back pain are often uncertain and subject to varied interpretations.   Radiologists estimate that approximately one quarter of the lumbosacral spine X rays reveal some abnormality.   Yet, clinically one often finds that patients with obvious X ray abnormalities may never experience low back discomfort, while at the same time a person with a normal radiographic finding of the spine might have great difficulty in moving about.   It is because of the undependability of X ray findings in low back pain that one is frequently involved in litigation in which the plaintiff claims severe and permanent pain while the defense minimizes the injury.

STRUCTURE OF THE SPINE

In order to better understand the problem of low back pain, one must have at least a basic knowledge of both the anatomy pathophysiology of the spinal column.   The description of the spine which follows is confined to its major elements.

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2. FINNESON, DIAGNOSIS AND MANAGEMENT OF PAIN SYNDROMES 185 (2d ed. 1969).

SPINOUS PROCESS

SUPERIOR ARTICULAR PROCESS

TRANSVERSE
PROCESS

VERTEBRAL FORAMEN

PEDICLE

BODY

TYPICAL LUMBAR VERTEBRA

LIGAMENTUM FLAVUM

INTERSPINOUS
LIGAMENT

POSTERIOR LONGITUDINAL
LIGAMENT

SUPRASPINOUS LIGAMENT
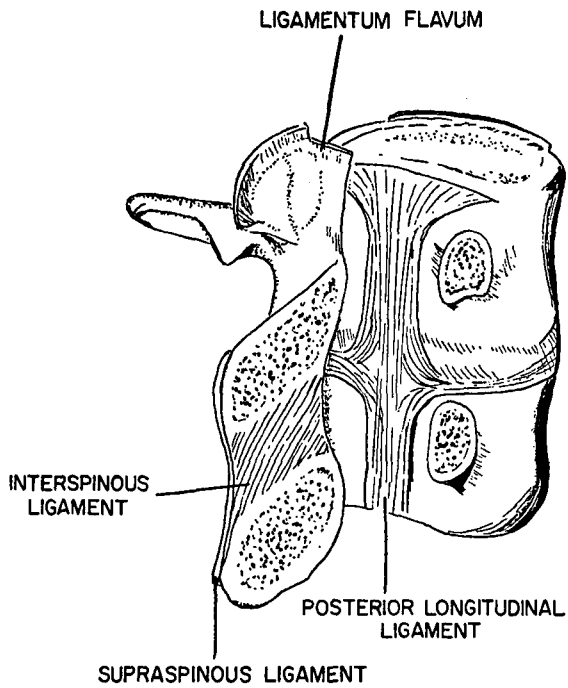
**LIGAMENTS OF
LUMBAR SPINE**

NEUCLUES PULPOSIS
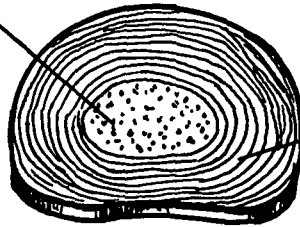
ANNULUS
FIDROSIS

INTERVERTEBRAL DISC

JOINT OF LUSCHKA
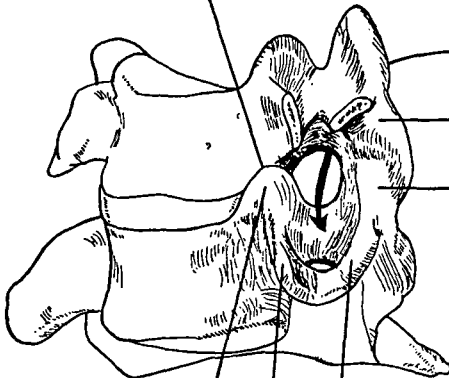
INTERVERTEBRAL FORAMEN

INFERIOR ARTICULAR PROCESS

SUPERIOR ARTICULAR PROCESS

UNCINATE PROCESS

POSTERIOR TUBERCLE

ANTERIOR TUBERCLE

FUNCTION UNIT

The human spine is composed of thirty-three vertebrae (seven cervical, twelve thoracic, five lumbar), a sacrum of five fused segments, and a coccyx of four fused segments. With the exception of the first and second cervical vertebrae, the vertebral bodies are separated from each other by intervertebral discs. One-fourth of the total length of the spinal column is composed of the height of the discs. During the course of a normal day, a person may lose from

SUPERIOR ARTICULAR PROCESS

SUPERIOR VERTEBRAL NOTCH

SPINOUS PROCESS

INFERIOR VERTEBRAL NOTCH

INFERIOR ARTICULAR PROCESS
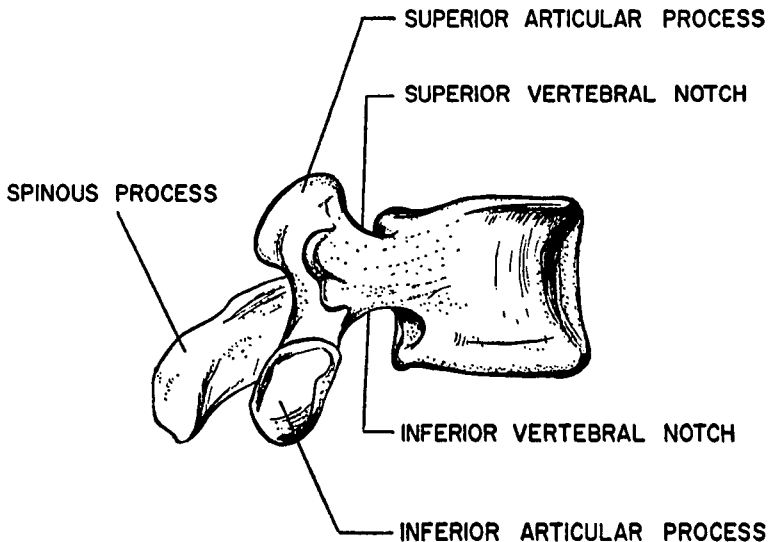
TYPICAL LUMBAR VERTEBRA

one-quarter to one-half inch in height because of shrinkage of the disc through dehydration and normal compression in the vertebrae caused by body weight. During the sleeping hours the discs become hydrated and that is the reason a person is apt to be somewhat taller upon arising in the morning.

With the exception of the first and second vertebrae, the normal vertebra consists of a body and a neural arch. The body and neural arch enclose an area known as the vertebral foramen, through which the spinal cord passes. The neural arch is composed of two pedicles, which form its sides, and two laminae which form its roof. A spinous process projects dorsally from the midline of the laminae. Extending laterally from the junction of the pedicles and laminae is the transverse process. Projecting upward from the junction of the pedicle and laminae, the superior articular process is found, and, projecting downward, the inferior articular process, which together form synovial joints between the two adjacent vertebrae. It is at this synovial joint that flexion, extension, and rotation take place. In the lumbar spine the articulation of the synovial joint is only possible in

forward and lateral flexion and hyperextension (backward motion), with only minimal rotation possible since the surfaces of the articulation lie in the sagittal plane.

On the lower border of each pedicle is found a deep notch and on the upper border a smaller notch, which together form the intervertebral foramina through which pass the spinal nerves which usually occupy the uppermost portion of the foramina. Resistance to stress by the vertebral column is augmented by the vertebral ligaments. These ligaments run vertically along the vertebral column, and by their attachment restrict excessive motion of the functional unit of the spine in any direction and prevent shearing stress.

The functional unit is composed of two adjacent vertebrae with their synovial articulation, and intervening disc, ligaments and nerves. The anterior longitudinal ligament extends over the anterior portion of the vertebral body enclosing the disc. The posterior longitudinal ligament extends over the posterior portion of the vertebral body; however, at the level of the first lumbar vertebra it begins to narrow so that by the time it reaches the fifth lumbar vertebra it is one-half its original width. This is significant since it contributes to an inherent structural weakness where the greatest stress to the spinal column is present due to the fact that this is where the greatest movement is present. There are other supporting ligaments, namely, ligamenta flava, which are interspinous ligaments which also contribute to the stability of the spinal column. Important, however, is the fact that the pain-sensitive tissues in the region of the functional unit are the anterior and posterior longitudinal ligaments, vertebral body, synovium and capsule of the apophyseal joint (articulation of superior and inferior articular process), nerve roots and muscles.

The muscles of the back which are significant can be divided into two main groups: the short muscles which extend from one vertebra to an adjacent vertebra, and the long muscles which cross a number of junction units. The short muscles and ligaments stabilize the individual segments of the spine, while the long muscles move a number of segments.

THE INTERVERTEBRAL DISC

The detailed anatomy of the intervertebral disc reveals that there are three main components intimately blended into a single functional

unit: namely, the hyaline cartilage plate, nucleus pulposus, and annulus fibrosis.[3]   The cartilage plates on the cranial and caudal surfaces of the intervertebral discs serve three principal functions: first, they are a growth zone; second, they help to anchor the disc; and lastly, they function as a barrier between the nucleus pulposus and the body of the vertebra.

The nucleus pulposus is centrally located and is composed of viscid gel with a high water content that decreases with age.   The main functions of the nucleus pulposus are: (1) fulcrum for movement (ball bearing action); (2) equalization of stress (when subject to force transmits this force equally in all directions); and (3) shock absorber.

The annulus fibrosis consists of collagen fibers which inclose the nucleus pulposus on its lateral side, whereas the cartilage plates on both the cranial and caudal surface inclose it from above and below. The function of the annulus fibrosis is to promote stability; it helps to bind the vertebral bodies together so that the spinal column moves and functions together as a whole.   It acts as a check-ligament, limiting movement of the spine.   It also acts as a containing envelope for the nucleus pulposus, as stated above, and lastly as a shock absorbing mechanism.   A tremendous force is required to tear or detach the annulus so as to permit dislocation between adjacent vertebrae.

DEGENERATIVE CHANGES IN THE INTERVERTEBRAL DISCS

The intervertebral disc reaches its greatest development at the end of the second decade of life.   From then on structural changes of a degenerative nature become increasingly evident.   Such degenerative changes can properly be regarded as the normal aging process, comparable with age changes seen elsewhere in the body.   However, disc changes commonly found in a man of sixty, if found in a man of thirty could be considered to be a pathologically degenerative disc. When the structural changes of age occur prematurely during an active period of life, what would ordinarily be normal stresses and strains, when inflicted on an unstable segment, may damage the disc severely.   The annulus may show tears running radially, most commonly in a posterior or posterior-lateral direction, and often asso-

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3. DE PALMA & ROTHMAN, THE INTERVERTEBRAL DISC 5-29 (1970).

ciated with extrusion of material from the nucleus pulposus through the rents in the annulus. Since posterior longitudinal ligament begins to narrow at the level of the first lumbar vertebra, and ultimately is one-half its width at the level of the fifth lumbar vertebra, it is not capable of containing the extruding nucleus pulposus, with the result that the nuclear mass compresses the nerve root as it leaves the spinal cord, with subsequent sciatic pain radiating to a lower extremity.

EFFECTS OF DISC DEGENERATION ON SURROUNDING STRUCTURES

One of the manifestations of disc degeneration is the radiological evidence of lipping or osteophytic formation of the vertebral bodies. Another effect of disc degeneration is severe damage to the posterior articular joints (apophyseal).

In flexion and extension the nucleus pulposus acts as a ball bearing. The vertebral bodies roll over the incompressible gel and the posterior joints guide and steady the movement. Once disc degeneration has begun, the movement taking place between adjacent spinal segments becomes uneven, excessive, and irregular. The instability associated with these structural changes in the disc may lead to fractures of the articular facets, as a result of trauma, subluxations and early osteoarthritic changes in the apophyseal joints, with fragments of cartilage forming loose bodies within the apophyseal joints.

Symptoms associated with disc degeneration may arise from the damaged disc itself. The annulus can no longer resist the deforming action of the body weight on the nucleus pulposus. The difficulty experienced in the low back region is the result of the tremendous work load concentrated in this relatively small area. Whenever an individual straightens up from a bent over position he is utilizing his lumbosacral spine as a fulcrum, which action concentrates a force of over a quarter of a ton on the lower lumbar and sacral region.[4] If an object is lifted from a bent over position the weight of the object can be multiplied by a leverage factor of twelve to sixteen depending upon the length of the torso and position of the arms. Thus, bending forward to pick up a relatively small weight can subject the lumbosacral spine to a stress of as much as half a ton or more.

4. Bartelink, *The Role of Abdominal Pressure in Relieving Pressure on the Lumbar Intervertebral Discs*, 39 J. BONE SURG. (BRIT.) 718-725 (1957).

During normal activities the vertebral column is frequently moved through its full range of motion. Such activity puts compression and shearing stress on the bony components of the back and tensile stresses on the ligaments and muscular components. Damage to any of these parts may give rise to pain. Because eighty to ninety percent of flexion occurs at the fourth and fifth lumbar vertebrae and between the fifth lumbar vertebra and the first sacral segment, we must expect the major stresses and major clinical problems to occur exactly at those levels.

Mechanically, the lumbar spine represents five bony blocks placed one upon the other and separated from each other by the intervertebral discs. They are maintained in the erect position only because the "guy-wires" represented by the muscles and ligaments maintain the vertebrae in position, one above the other. The shearing force or forward slipping of one vertebra over another is prevented by the apophyseal joints. The muscles have the dual role of balancing and supporting the vertebral column whether it is at rest or during activity. When a posture is kept for a prolonged period of time, the muscles relax due to fatigue and the vertebrae sag against the ligaments, which then take on a greater role in maintaining the elements of the spine in proper position. Control of extension of the lumbar spine is provided by the anterior longitudinal ligament. Control of flexion is provided by the muscles of the back and the range of lumbar flexion is limited by the posterior ligaments: namely, supraspinous ligaments, interspinous ligaments, ligamenta flava, and posterior longitudinal ligaments.

The increasingly sedentary habits of the population are undoubtedly a factor in the widely prevalent problem of low back pain. The ease of living has lead to less actual use of the muscles of the back, with consequent deconditioning of the muscles and an increase in the load being borne by the ligamentous and bony structure of the back. This deconditioning of the muscles leaves the back more susceptible to stress, with resulting painful derangement of the back. The lower back is then forced to tolerate tremendous loads without adequate preparation. A person with deconditioned musculature of the back gambles that his ligaments and tissues alone will be able to support sudden or unexpected loads.

EXAMINATION OF THE LOWER BACK

A careful history is imperative in conditions involving low back pain, from both a medical and legal point of view. It is important to ascertain whether the pain appeared suddenly or developed gradually. Was there an acute traumatic incident or did the pain follow unusual exertion on the part of the patient? Does the pain radiate? Has the pain lessened or has it become worse? Is it aggravated by coughing or sneezing? In addition, age, sex, economic background, occupation and past history of illness and injuries become an important part of the history. Another important factor that should be determined is whether litigation is anticipated, or whether compensation is likely to be a factor.

After a careful history is obtained, examination of the back should be undertaken. The examination begins with careful observation of the patient from the moment he walks into the office; a study of his gait while he walks to a chair; and whether he shows discomfort when he sits down. Patients with degenerative disc disease do not tolerate sitting very well, and usually complain of numbness and pain radiating to the lower extremity. The patient is observed while disrobing. Once disrobed, the posture of the patient should be studied and lateral deviations of the spinal column noted, if present. The comparative heights of the iliac crests are compared and any inability to stand fully erect or relaxed with hips and knees fully extended should be noted. Increase or flattening of the lumbar curve should also be noted. The next step is the laying on of hands for palpation of the lumbar musculature in order to detect spasm of the paraspinal musculature. The patient should be asked to bend forward, backward, and to either side while the musculature of the back is palpated for possible spasm, and the curve of movement of the spine is observed. With the patient in a standing position visual observation should be made concerning the thigh and calf musculature. The sciatic notches, and the posterior thighs and calves are palpated for deep tenderness and muscle spasm.

In the supine position, patellar and Achilles reflexes are tested for hypoactivity, and while in this position circumference measurements are made six inches above and below the mid-patella for atrophy of the lower extremity (an important finding suggesting disc lesions

with peripheral sciatic nerve involvement). Measurements of the length of both lower extremities for comparative purposes are also made in the supine position, the leg length being measured from the superior iliac crest of the pelvis to the internal malleolus of the ankle. If one limb is found to be shorter than the other this is no necessary indication that it resulted from the injury since it was very probably of congenital origin. The result of the ensuing imbalance may itself be the cause of the low back pain rather than any specific injury.

Sensation of the lower extremities is tested with pin; loss of sensation indicating evidences of nerve root compression with resultant numbness.

Extensors of both large toes (extensor hallucis longus) are tested by asking the patient to extend his large toe against resistance of the examiner's fingers; if extension is weak this indicates involvement of the lumbar fifth nerve root.

Various tests involving passive bending of the low back or legs are done routinely to determine whether mechanical abnormalities exist. The most frequently used tests are the following:

Patrick or Faberé Test: Patient is in the supine position, the heel of one leg is placed on the opposite knee and the leg thus flexed is forced to the table. The test is positive when it elicits pain in the hip joint or sacrioliac joint.

Straight Leg Test or Lasegue's Test: Patient is in the supine position, leg with knee straight is flexed upwards from the hip to 90 degrees; normal range of flexion at the hip is 100 to 120 degrees without pain. If pain in the buttocks is present radiating to the heel before arriving at a 60 degree angle, then it is considered positive and is indicative of sciatic nerve involvement.

Nachlas Knee Flexion Test: With the patient lying face downwards (prone), the knee is flexed backwards; if pain occurs at the site of either the sacroiliac or lumbosacral joint as the heel approaches the buttock this suggests involvement of these joints.

Ely's Test: With the patient in prone position, the heel is drawn towards the buttock; it is a positive sign of lumbosacral involvement if the pelvis rises as the heel is pressed further toward the buttock.

X rays and Electromyography: X rays in low back pain should be

utilized routinely. Routine anterior-posterior and lateral plates will show the bony conformation and the intervertebral disc spaces. However, views from other angles are essential to observe more detailed information regarding the lumbosacral joint and apophyseal joints. A spot film may show more details of the lumbosacral joint. Oblique X rays in the planes of the apophyseal joints may give information regarding malpositioning or arthritic changes in these joints. X rays taken while the patient bends laterally as well as assuming positions involving flexion and extension are frequently helpful in localizing the area of trauma. These are commonly called functional X rays.

In recent years electromyography, in which the electrical activity produced by a muscle is studied, has been used as a diagnostic tool to determine damage to a single nerve root. Compression caused by a protruded intervertebral disc causes denervation only in the muscles which receive innervations from that root. Diagnostically "fibrillation potentials" indicate positive findings in disc lesions. Thus, this tool has been used very effectively in localizing the lesion and has, in a great many instances, replaced the use of myelogram studies. However, the myelogram still remains an important diagnostic method to localize the protruding disc lesion.

LOW BACK CONDITIONS

Low back pain is caused by many etiological possibilities besides trauma caused by sudden injury or excessive strain. In arriving at the truth many possibilities must be evaluated. The causes of low back pain may be influenced by consideration of age, sex, congenital anomalies, developmental defects, postural abnormalities, mechanical strain, trauma, visceral lesions, gynecological and obstetrical problems, and urological lesions, to name but a few of the etiological factors. In this paper a few of the most common causes of low back pain, its pathophysiology and treatment are attempted.

ACUTE LUMBOSACRAL STRAIN

This condition is usually brought about by injury to the lower back in the form of direct trauma to the back or a fall in which the low back region is twisted. It may also be brought about by lifting

excessive loads; patients with deconditioned musculature are not able to sustain the sudden stress and become subject to myositis and fibrositis. The resulting trauma to the low back invariably causes discomfort. Initially the pain may not be severe but is associated with stiffness of the back due to muscle spasm which is a protective mechanism associated with the injury. The acute muscle spasm usually worsens with activity and the pain associated with the spasm becomes so severe that the patient is usually found confined to bed or a hard surface, such as the floor. The slightest motion on his part may cause unbearable pain. Generally, however, the acute symptoms are less severe than described above; the pain is usually localized in one side of the back with accompanying spasm of the paraspinal musculature. Because of this spasm on one side, muscle shortening occurs and creates a scoliosis (lateral bending) of the spine with the concavity on the side of the spasm. This is due to the contracture of the spastic muscle. Forward flexion of the trunk is limited, with pain in the lower back. If the muscle spasm is bilateral in the paraspinal musculature, the normal lumbar lordotic curvature of the spine is abnormally straightened.

In examining for acute lumbosacral strain, visual inspection is used, the muscles are palpated for spasm, body movements are observed, and an examination is made for reflex and sensory modalities. In lumbosacral strain, reflex and sensory modalities are usually within normal limits. Straight leg raising tests may also be normal, as well as X-ray examination. However, despite these normal appearances, muscle spasm may be present and producing the straightening of the normal lumbar curve, or scoliosis.

Treatment consists of complete bed rest: a firm mattress with a bed board placed under it. Pelvic traction is often useful, with the foot end of the bed elevated; or, if a hospital bed is available, the bed is "gatched" so that the hips and knees are semiflexed. Muscle relaxant drugs are used, as well as physiotherapy in the form of moist heat applications. With bed rest, traction, muscle relaxants, and moist heat the muscle spasm gradually disappears. At this time light bed exercises should be begun for reconditioning the back musculature. After several days of exercise, a back brace or corset is prescribed so that the patient can ambulate. (The pros and cons of prescribing back braces will be discussed in a later portion of this pa-

per.) Back exercises should be continued during the convalescence of the patient in spite of the fact that a brace or corset has been prescribed, and he should be weaned away from the corset gradually, lest he becomes dependent upon it. He should not be allowed to return to work until prescribed exercises can be performed without pain. The prognosis is generally good if the patient follows the exercise regimen faithfully.

CHRONIC LUMBOSACRAL STRAIN

This is the most common low back problem found in practice. It is a disease resulting from mechanical stress upon the lower spine due to a combination of faulty posture and inadequate musculature. After the age of thirty—thirty-five years the ligaments tend to lose their normal elasticity and become more fibrous in nature. Prior to this age the spinal ligaments can adjust to poor posture in spite of improper muscular support, but when the ligaments can no longer adjust, a greater work load is taken over by the already deconditioned paraspinal musculature, which produces abnormal stress and strain, with resultant pain in the lumbar area. If this condition persists over a number of years, hypertrophic osteoarthritic changes take place in the vertebrae, with formation of spurring and lipping, and become an additional source of pain to the low back area.

Most patients complain of backache, with pain not localized to a specific area. The pain is diffuse and not very severe, but ranges from mild to moderate. If a history of a fall or other trauma is given, on careful questioning one can frequently elicit a history of "nagging backaches" predating the injury. This is suggestive of chronic lumbosacral strain. A common statement by the patient is that he had previously had a tired feeling in the back, and that activity usually aggravated it, with bed rest relieving the pain.

Clinical findings usually reveal poor posture. There may be some mild evidences of muscular spasm of the lumbar muscles. Hyperextension of the back produces an ache in the back; tests for reflexes and sensation, as well as straight leg tests, are normal. X rays are generally normal except for the fact that there may be an increase in the normal lordotic curvature.

Chronic low back syndrome is the result of deconditioning of the

ligaments and musculature and is present beyond the age of thirty-five when the patient is insufficiently active. A person will ride when he should walk, and does not indulge in the systematic routine of general exercises. Relaxation of the abdominal muscles due to lack of exercise brings about the "middle age paunch." Strong abdominal musculature increases intra-abdominal pressure, and in so doing reduces the load on the spine and intervertebral discs. Persons with strong abdominal musculature, as in weight lifters, are seldom troubled by lumbar involvement. If the abdominal musculature is inadequate, the application of a lumbar support or corset with an abdominal apron increases the intra-abdominal pressure and so acts to relieve pain in the spinal column.[5] Treatment which consists of a regimen of corrective postural exercises is instituted, and is designed to increase the strength of the lower back as well as of the abdominal musculature. The patient must be taught the proper exercises. These exercises must be carefully taught and supervised until the patient is capable of continuing on his own. He must also be taught the proper way to sit, stand and walk. Aside from exercise, the usual bed board and proper mattress are prescribed, as well as muscle relaxants, if necessary, adequate rest, firm straight chairs for sitting, and a back support for driving. He must be taught how to lift objects properly, as described before. A program of this type will usually be effective within several months.

OSTEOARTHRITIS OF THE SPINE OR HYPERTROPHIC
ARTHRITIS OF THE VERTEBRAE

The spine is the most common site for osteoarthritis. The changes take place at the junction of the bony portion of the vertebrae and cartilage plate. The cartilage becomes irregular and thready, and proliferation takes place at this junction. Ankylosis is not a characteristic of this entity although motion may be greatly decreased at the site of the lesion by bony overgrowth.

In old age, the body, as does any other machine, shows the effects of wear and tear. In patients over the age of fifty, who are overweight and who have postural and mechanical defects, osteoarthritis is naturally more frequent and severe. Old injuries, ofttimes forgot-

5. *Id.* at 724.

ten, may have laid the foundation for later osteoarthritis. Such traumas are frequently not even remembered by the patient. Multiple minimal injuries in almost any daily activity contribute as microtrauma to the syndrome of osteoarthritis.

The symptoms of osteoarthritis of the back are stiffness associated with pain. The patient tires easily upon exertion and symptoms are worse in cold, damp weather. In advanced cases limitation of motion is present due to spur and lipping formation of bone. These bony overgrowths may narrow the canal through which the spinal nerve passes and cause radicular pain and subsequent atrophy of the corresponding musculature which the nerve supplies. Laboratory findings often are not diagnostic. X rays reveal thinning of the cartilage, spurs, lipping and bridging between adjacent vertebrae.

Treatment: The stiffness and discomfort may be relieved by rest, support, and heat. Rest and adjustment of physical activity to a level that the affected joints will tolerate, reduction in weight, aspirin, local heat in the form of hot packs or diathermy are the treatments of choice. Despite evidences of advanced changes on X rays, the patient will experience little pain when a therapeutic regimen is diligently followed.

HERNIATED LUMBAR DISC

In the lower lumbar region degenerative changes in the intervertebral disc are a frequent cause of back pain and rupture of disc material is the most common cause of sciatic pain. Although this lesion does not affect the general health of the patient, it often results in prolonged disability and great economic loss to the wage earner. In many instances the patient may not be able to return to his previous occupation and vocational rehabilitation is indicated so that he might be able to perform in another field.

While some people with degenerative changes develop lumbar disc lesions, others do not. The reason for this is not always apparent. In a previous section of this paper we have discussed the anatomy of the functional unit of the lumbar vertebrae with their bony, muscular, ligamentous, and disc structures. We have also discussed the intervertebral disc and its structure. All of these structures undergo characteristic progressive changes from the beginning to the

end of life. It is often next to impossible to distinguish between what is normal aging process and what is pathological. As stated previously, abnormal degenerative changes present in a young adult are considered pathological. Associated with the thinning of the discs and the aging changes in the nucleus and annulus, reactive changes occur along the margins of the vertebral bodies. Bony spurring and lipping occur. However, in this process the synovial joints are not involved. Some authors prefer to refer to this process as "spondylosis," *i.e.*, changes in the body of the vertebrae and not in the apophyseal joints, as seen in osteoarthritis of the spine.

Rupture of a normal disc is uncommon. Acute disc rupture is usually the result of a combination of acute trauma and pre-existing degenerative changes. If the degenerative changes were minimal, one must assume that the trauma must have been relatively severe in order to cause a rupture of the nucleus. However, if the degenerative changes were extensive, then minimal trauma, as in bending, might produce rupture of the nucleus and symptoms of sciatica. Most disc ruptures occur in the third and fourth decades, which represent the most active period of adult life. Most disc herniations in the lumbar spine occur at the two lower interspaces. Approximately ninety percent of disc ruptures occur either between the fourth and fifth lumbar level and usually involve the fifth lumbar root, or rupture at the fifth lumbar level and the first sacral level, and generally include the first sacral root. Ruptures through the degenerative annulus generally occur in the thin posterior portion, and since, as we have seen, anatomically the posterior longitudinal ligament is half its width in the lumbar regions, the nucleus is capable of impinging upon the nerve root at the level of rupture, as it leaves the spinal cord and thereby causes symptoms of sciatica. Disc herniation that does not involve the nerve root may result in back pain without sciatica.

Clinically, the classic picture of lumbar disc disease is associated with low back pain radiating to one or both lower extremities. The pain is first noted in the back and the onset may be insidious or abrupt. The patient often states that he has had previous backaches with no radiating pains to the lower extremities and that the backaches subsided with rest. In some cases, however, but certainly not in the majority, the onset is associated with significant trauma. Frequently a specific episode is cited by the patient, such as lifting

a heavy weight or a fall. He may experience a significant snapping sensation in the lower back and attribute this sudden onset to trauma precipitated by the incident. Other patients may attribute the onset of pain to the back to a stooping incident, while others cannot date the onset, but become aware of gradually increased pain in the back. Clinically, the patient describes his pain as a deep aching pain in the back with sharp stabbing pains to the lower extremity, associated with a sensation of pins and needles and numbness in the lower extremities. The pain is aggravated by weight bearing, spinal motion, coughing and sneezing, and sitting. Relief is obtained by lying flat on a hard surface.

On examination the patient holds his back rigidly since the lumbar lordosis is flattened due to muscle spasm. A lateral bending of the spine (scoliosis) is toward or away from the painful side, depending upon where the protrusion of the disc takes place. Palpation reveals spasm of the musculature. Abnormalities in the lower extremity are variable depending upon whether the nerve root is completely or partially damaged. Damage to the nerve root is manifested by muscle weakness and atrophy (determined by muscle testing and measurements), reflex changes (decreased due to peripheral nerve involvement), and sensory disturbance (determined by needle testing). Electromyography may be used as a confirmatory tool to detect motor impairment. Patrick and Lasegue tests are performed; heel and toe raising are used to easily determine the muscle power in the lower extremities. X rays and myelogram studies are included under special tests in addition to electromyography.

Management of the lumbar disc involvement is broken up into two categories; conservative and radical (surgery). In the acute stage, rest in bed, a firm mattress, bed board, and muscle relaxant drugs are prescribed. Aspirin is usually adequate to allay pain. However, if narcotics such as demerol, codein, etc. are necessary, they should be used cautiously and over a very short period of time. One must be mindful also to relieve constipation which is frequently caused by inactivity, as well as by the use of narcotics. In addition to its general undesirability, constipation can bring about unnecessary straining and resultant increase of pain in the lower back. Pelvic traction is applied for the purpose of increasing the anterior tilt of the pelvis, which in turn helps to distend the intervertebral disc space, and thereby al-

leviates the pressure of the body weight at the site of the pathology. Pelvic traction is applied with about fifteen to thirty pound weights, while the foot part of the bed is elevated four to five inches so that the patient is not pulled toward the end of the bed since his body acts as a counter-traction. Buck's extension traction, which is always applied to the legs, should never be used in disc disease since the force of traction is transmitted to the knees and hip joints, with little force being exerted on the intervertebral discs.

After the acute symptoms of pain have subsided, graduated exercises of the back and abdominal musculature are started, and the patient is fitted for a brace or corset before being permitted to ambulate. Crutches may be prescribed to limit weight bearing. The patient is instructed to avoid bending, heavy lifting, and stair climbing for at least two weeks. The back support is worn for at least eight weeks and then the patient is gradually weaned away from the use of the support. Exercises to the abdominal and back musculature continue as the patient improves so that the increased lumbar lordosis is further decreased.

Manipulation of the spinal column in the treatment of ruptured discs is a hazardous technique and should only be done by skilled practitioners. In some instances relief of pain may be dramatic due to a shift in the nuclear material. However, if forceful manipulation is used in situations where underlying pathology exists such as osteoporosis, arthritis or malignancies, serious damage, with possible paraplegia may result.

If an adequate trial of conservative measures fails, surgical procedures should be considered. Probably less than twenty-five percent of all patients with lumbar disc involvement require surgical treatment.[6] The indications for surgery are failure to improve in spite of conservative treatment, progressively worsening neurological findings, and inability to continue to function in one's occupation. The physician must also be alert to the fact that the patient must be informed that, in spite of the fact that removal of a herniated disc does not represent a formidable procedure in the hands of competent surgeons, the offending condition may not be totally eliminated.

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6. Stauffer, Ivins, & Miller, *The Lumbar Disc Syndrome and Its Operative Treatment*, 49 POSTGRADUATE MEDICINE 92-93 (1971).

Two types of surgical procedures are commonly involved. These are known as laminectomy and spine fusion. The surgical procedure for the removal of the ruptured disc is known as a laminectomy. Spinal fusion consists of grafting bone at the site of the operational procedure involving the laminectomy. Spinal fusion is used when some structural deformity of the spine exists or where there is good reason to believe that persistent backaches would follow laminectomy alone.

When a laminectomy is done, the posterior bony portion of the vertebra and the disc space material are removed. The intervertebral foramen through which the nerve root passes may also be enlarged (foraminotomy) so as not to create additional compression upon the nerve root. In one to two days following the laminectomy, the patient may be ambulated with a Knight brace and can usually be discharged from the hospital in one week to ten days. The brace is to be worn for approximately twelve weeks except when the patient is in bed. The average length of disability for a person with a sedentary occupation is approximately six weeks and for a manual laborer twelve weeks.

Spinal fusions are usually not done routinely in connection with or following laminectomy unless either advanced degenerative changes or mechanical instability of the spine is present. As a general rule, laminectomy alone suffices and the convalescent period is considerably less than it is when a spinal fusion is involved. When properly managed, about ninety percent of the patients having surgery for lumbar disc involvement make good recoveries no matter which of the two procedures is indicated. Nevertheless, some authorities contend that spinal fusion unnecessarily increases the risk of resultant morbidity and does not result in significant improvement. In their opinion satisfactory results are achieved by laminectomy alone in approximately eighty-five percent of the cases, whereas when spine fusion is also used satisfactory results are achieved in fifty to seventy-eight percent of the cases. It must be remembered, however, that frequently when spinal fusion is carried out it is indicated because of specific pathology in the spine. Recent reports indicate that new techniques of spinal fusion give promise of improving results of this procedure.

THE USE OF BRACES IN LOW BACK PAIN

While spinal braces may be necessary to achieve spinal immobiliza-
tion in the treatment of spinal disorders, there are numerous disad-
vantages associated with their use. In a paper presented by Paul L.
Norton and Thornton Brown,[7] they reported that they had found
that there is a tendency for spinal motion to be increased in the seg-
ments adjacent to the ends of the appliance. They were able to show
that when a spinal brace which extended only to the upper part of
the pelvis was worn there was increased lumbosacral motion during
trunk flexion, which resulted in increased pain. They further indi-
cated that, in order to limit this motion at the lumbar sacral joint,
the brace should extend well down onto the pelvis and grip it firmly.
In addition to the support to the back, a very important feature of
any belt or brace is the abdominal support which creates an increase
in abdominal pressure through its compressive action on the abdo-
men and thus relieves the pain in the spinal column. The most
frequently used braces and corsets in connection with the support of
the lumbar spine are the Knight brace for maximum limitation of
anterior and posterior motion, the Chairback brace to limit lateral
motion, and the Williams brace to limit posterior and lateral motion.
The lumbosacral corsets are cloth garments that wrap around the
torso and hips and serve to restrict anterior and posterior motion,
and, by means of the abdominal apron, help to reduce the weight on
the vertebrae and discs. Again, it must be emphatically stated that
the patient should be weaned away from artificial support as soon as
possible and such support should not be allowed to become a sub-
stitute for strengthened musculature of the abdomen and low back.

ST. JOHN'S LAW SCHOOL PROGRAM

The program at the School of Law of St. John's University in Brook-
lyn, New York, is contained in a course titled Legal Medicine. The
catalogue description indicates that the course includes a survey of
the more common types of medical problems likely to be encoun-
tered in the practice of law. The role of expert medical testimony
is considered in relation to tort cases, will contests, and criminal pro-

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7. Norton & Brown, *The Immobilizing Efficiency of Back Braces: Their Effect
on the Posture and Motion of the Lumbosacral Spine,* 39A J. BONE JOINT SURG.
111-139 (1957).

ceedings, and the growing fields of workmen's compensation, disability benefits and industrial medicine.

The course consists of a series of lectures on the legal aspects of medically related problems, supplemented by a series of lectures by medical specialists in a variety of areas including roentgenologists, urologists, orthopedists, physiatrists, and neurologists. From the medical point of view, the student receives an orientation in a variety of basic aspects of medical knowledge. Typically, these include the anatomy of the central nervous system, the musculoskeletal system, the use of X rays, fractures, and rehabilitation. The law lectures, on the other hand, pertain to such subjects as medical testimony, direct and cross-examination, and the appropriate use of medical material. Student assignments consist of typical medico-legal problems in which the student is expected to prepare his own case from both the medical and legal point of view. For example, the case might be posited as a fracture of the tibia, femur, or skull, or as a low back injury, resulting from a traumatic episode. Standard medical references are supplied, as well as information as to where they are to be found, and the student may, in addition, consult a physician, although he is urged to do the basic research himself. He is, of course, encouraged to search out additional reference material on his own if he wishes to do so. The student is taught to work up his case in a competent manner so as to include every aspect of the situation; how, when, and why the accident occurred, detailed information on hospitalization, the findings of the examining physician, and all of the developments which followed that affected the patient's condition. After the case is written up both from a medical and a legal point of view, it is presented in class and the student is examined orally by the law professor and a physician. Valuable class discussion follows and at the end of the course, the standard examination is used and includes questions on basic medical terminology, research, and typical medico-legal problems.

Experience with this course has been excellent. While it still remains an elective course, it is eagerly sought after and is received with enthusiasm. The presentations which are made are excellent, contain good bibliography, and are followed by intense participation in the discussion period.

CONCLUSION

The problem of handling medico-legal situations is a complex one. That clients are entitled to the best representation possible goes without saying. Nevertheless, attorneys who are unwittingly naive about the medical realities affecting the client's case are in no position to do so. The consequence is that the client is under-represented without the knowledge of either himself or his attorney.

An attempt has been made in this article to illustrate the importance to the attorney of understanding in some detail the medical elements involved in some of the major aspects of low back pain because of its frequency in legal proceedings. The material presented was not designed to be comprehensive, but rather to outline the principal anatomical details and some of the types of pathology which are most likely to appear in legal practice. The material presented is intended to serve several purposes; on the one hand to present useful material on low back pain and, at the same time, to illustrate the need for the attorney to inform himself in similar detail whatever the medical problem which might arise in his practice. The successful program at the St. John's Law School in Brooklyn, New York, was outlined in order to reinforce the major thesis of this article and to point to the fact that attorneys should be geared to this type of thinking during the period of their legal training.

The subtleties which arise in medico-legal practice, and which ultimately become a part of the armamentarium of the experienced attorney, are vast. Several examples follow which illustrate this fact. One aspect which is frequently neglected is the relationship of disability to the aging process. When seeking to ascertain the percentage of disability which has been sustained it is important for the attorney to keep in mind that that percentage will not necessarily be a static factor, but may well increase as the client gets older, and may, in fact, accelerate the pace at which the client arrives at a point at which he will no longer be able to work and will be forced to retire. If the attorney does not realize this possibility, he will tend to be unrealistic in calculating the loss which his client has suffered.

Another crucial element has to do with the examination of witnesses. Knowledge of pertinent medical facts is of fundamental importance in dealing with physician witnesses, whether hostile or

friendly.   Some of the ramifications of this subject were discussed by the present author in an article entitled "Rehabilitation and Trauma."[8] The entire subject of dealing with physician witnesses is in need of further explication, but this subject goes beyond the scope of the present article.   Similarly, the role and function of rehabilitation medicine is outlined in the same article in some detail.   Without an understanding of the role of rehabilitation medicine in enabling the client to achieve the maximum degree of functional recovery of which he is capable, the attorney on either side of the case will be incapable of properly assessing either the medical or economic realities of the injury.

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8.   Goldstein, *Rehabilitation and Trauma,* 18 DEPAUL LAW REVIEW 620 (1969).

SUPPLEMENTARY GLOSSARY

ankylosis	The abnormal union of the bones of a joint.
caudal	Anatomical position denoting the lowest position.
collagen fibers	Elongated, threadlike structures contained in main supportive protein of skin, cartilage and connective tissue.
electromyography	The recording of the changes in electric potential of muscle.
fibrositis	Inflammation of the fibrous tissue of the body, especially muscle sheaths. Also called muscular rheumatism.
foramina	A natural opening or passage, especially one into or through a bone.
gatched bed	A bed fitted with a joint by which the patient can be raised into a half sitting position.
iliac crest	The upper rim of the top bone of the hip.
lordosis	An abnormal increase in concavity in the curvature of the lumbar spine when viewed from the side.
laminectomy	Excision of posterior arch of a vertebra.
malleolus	Bony protruberance on either side of ankle.
myelogram	X ray of the spinal cord after injection of a contrast medium.
myositis	Inflammation of voluntary muscle.
osteophytic	A bony outgrowth or enlargement.
paraplegia	Paralysis of the lower legs and lower part of body, both motion and sensation being affected.
radicular	Radiating from the root of a nerve.
sagittal plane	Section through the body parallel to the long axis of the body.
sciatic notch	Area through which the sciatic nerve passes in the ischial bone of pelvis.
subluxation	An incomplete or partial dislocation.