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LOW BACK INJURIES – THE RUPTURED DISC SYNDROME*

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Accidents or injuries which involve the lower back, or more particularly one of the lumbar discs, give rise to frequent litigation. Most of the complaints referable to the low back were formerly labeled lumbago, sciatica, or sacro-iliac sprain. Today most authorities agree that the older terminology was not only inadequate, but was incorrect in so far as localization of the anatomy responsible for the difficulty was concerned.

Before any attempt is made to explain fully the ruptured disc syndrome, it is necessary that we first make it perfectly clear that there is still a great lack of knowledge of the exact pain mechanisms and pathological processes which produce and are responsible for low back pain. There is much research being carried on both in this country and abroad. Soon, we hope, we can present the whole correct picture of the cause and the treatment for all low back disabilities.

When we speak of the low back we refer to the area extending from about the tenth rib to about the middle of the buttocks. It is important to understand some of the fundamental anatomy of the area before the complicated disc syndrome is discussed.[1] The spinal column which extends from the skull to the pelvis is the means by which we remain upright. Were the column rigid, it would be difficult for the human to resist forces that would tend to tip the body. Nature provided curves so that bending forces could better be resisted. The spinal column of the newborn forms a continuous rod from the pelvis to the skull with the convexity backward. As the infant grows and assumes the upright position, the portion of the spine nearest the head, composed of seven cervical vertebrae, develops a convexity

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1. *Grays Anatomy*, 25 Edit, pp. 204.

forward. The next portion of the spine, the so-called dorsal spine or the area in the middle of the back composed of twelve vertebrae, maintains the curve with the convexity backward while the lower spine, composed of five lumbar vertebrae, develops a curve which has a forward convexity. As standing is attempted, the pelvis inclines forward for balance. The result of these functional changes is that in adult life the human has three spinal curves. First,[2] the cervical lordosis, which simply means that the spine had a convexity forward, the dorsal kyphosis, which means that there is a convexity backward, and the lumbar lordosis, which indicates, as in the cervical spine, that there is a forward convexity.

The muscles of the spine and abdomen, by reflex control, constantly serve as balancers to maintain the flexible spinal column in such a way that the head is centered over the middle of the pelvis. The vertebral bodies are bound to one another by strong ligaments which are flexible in back and relatively inflexible in front. Beyond the ligaments are the strong muscle groups which help maintain stability and provide some flexibility. Between each vertebral body and helping to maintain stability is an inter-vertebral disc. The anatomic and physiologic properties of the disc are not completely understood but we do know that the disc has an intrinsic turgor which has to do with its property of water retention. In the middle of the disc is a so-called nucleus-pulposus, a semi-gelatinous material which is confined within the disc by a stout ligamentous type of tissue. Picture, if you will, five bricks representing the five lumbar vertebrae. In between each brick is a wet mortar in the middle of which is placed a piece of flexible rubber about one-half the size of a walnut. As pressure is made on the top brick, it will be noticed that a great deal of the stress is taken up by the mortar and the elastic rubber substance. When water is removed from the mortar, there will be changes noticed in the elasticity and the flexibility and stability of the whole unit, composed of the five bricks.[3] The reader is urged to examine drawings and diagrams available in standard texts of anatomy and familiarize himself with such terms as the anterior longitudinal ligament, the nucleus-pulposus, the annulus, the ligamentum sub-flavum, the articular facets or joints upon which each vertebra moves as an independent unit, and finally to note the relationship of the spinal cord and the spinal nerves to the back portion of the disc.

Since space does not permit a complete description of the pathology, anatomy, diagnosis, and treatment of all low back pain, we shall limit

2. *Grays Anatomy*, 25 Edit, pp. 94.
3. *Grays Anatomy*, 25 Edit, pp 276

ourselves to a discussion of involvements of the lumbar discs, particularly since deterioration and injury of an individual disc is frequently productive of backache. Indeed, it is said that more than 80% of all backaches accompanied by sciatica or pain extending down the back of the leg along the course of the sciatic nerve is due to the so-called disc syndrome or ruptured disc.

The normal disc[4] reaches its greatest development at about the nineteenth or twentieth year. The aging process begins at or just after that time. It consists of a gradual drying out of the disc and as stresses are exerted, cracks begin to occur in the annulus. These are found with a greatest frequency in the fourth and fifth lumbar discs. A protrusion of the nucleus can occur through a tear in the annulus. Forced motion, as when the body is bent backward or into extension, may give rise to further injury to the annulus and be responsible for ruptures of the nucleus. Narrowing of the disc space is common particularly after injury and following the loss of much of its water content. Bony spurs, which are secondary to the development of arthritis, may be seen to develop at the margins of the disc. When the spurs or osteophytes develop posteriorly, or in the back of the vertebra, they may impinge on the nerve roots and be responsible for pain which radiates or runs down along the course of the nerve. Occasionally the nerve roots may be scarred because of the proximity of the spurs. When there is settling of the disc, there may be overriding of the facets or the joints upon which each vertebra articulates with its fellow vertebra above and below.

A report of a typical case treated in my office and later litigated may best demonstrate the medical-legal complexities of the ruptured disc syndrome.

John T., a 37-year-old white male, who had previously been in good health, developed, on May 27, 1956, a severe pain in his low back. He stated that he had never had any previous injuries, that he had been engaged in the same type of work for eleven years, and that while his work was fairly heavy, he never had to lift weights of over fifty to sixty pounds. At 3:30 P.M., he and three other fellow workers were lifting a crate weighing 210 pounds from a platform to a truck. The patient had to suddenly drop his end of the crate and fell to the ground. He was taken to the plant medical officer where a cursory examination was made and a prescription was given him for some sedatives. He was told to return home, sleep on a firm mattress, apply some wet heat to the back and return in the morning for observation. In the morning, the patient's back was no better.

4. Bradford & Spurling, *The Intervertebral Disc*, C. B. Mosby-Publisher.

If anything he was somewhat worse. The back was rigid and he now complained of pain running down into his left leg. It was then that the plant physician referred him to me and my examination was begun.

The first part of every examination consists of a history. The patient is asked leading questions which are relevant to the injury and which help the examining physician to eliminate certain possibilities and admit others. For instance, the question of whether or not the patient had been doing the same type of work for a number of years would tend to suggest that muscles that were infrequently used were suddenly called into play and might have been subjected to strains. Another question as to whether or not the patient has lost a great deal of weight in the past year or so suggests the possibility of malignancy. Exposure to tuberculosis or other infectious diseases can often lead to a diagnosis that otherwise eludes the surgeon. Does the patient awaken in the morning with his back stiff and does it feel better after he moves about? That history suggests arthritis. Has the patient had recurrent attacks? Did he have a weak back when he was a child? These and similar questions suggest a possible aggravation of a pre-existing congenital type of abnormality. Does the patient have increased pain on coughing or sneezing and does the pain run all the way down to his leg and foot? An intra-spinal lesion is thus often brought to light even before the patient has actually had his physical examination. Questions which the layman and even the lawyer often feel are irrelevant are very important. Failure to make a diagnosis often rests on so-called sins of omission rather than commission. The omission of asking proper questions may often mean the difference between making or not making a correct diagnosis.

Our patient denied ever having had any back difficulty before. He did have increased pain on coughing and sneezing and he complained of pain which ran from his low back into his left buttock, down the back of his leg, and into the side of his foot. He was unable to rest at night and he couldn't make himself comfortable while sitting.

The physical examination revealed the patient to be well muscled, five feet ten inches tall, one hundred and seventy-five pounds, and fairly well tattooed, on the forearms and over the chest. I made a mental note to be sure and do a Wasserman and Kahn blood test. A fairly high percentage of my tattooed patients have had 4+ Wassermans, indicating that at sometime during their love life, they had failed to heed the admonition, "fifteen minutes with Venus and six months with Mercury", or shall we substitute Penicillin for Mercury in these days of modern anti-biotics.

I watched the patient undress and noted that he kept his back rigidly straight, that he could lean forward fairly well but could not bend backward to any degree. The process of undressing was painful.

The patient was asked to bend forward and a note was made of the rigid muscles of the lower portion of the back which stood out like cords, particularly when the patient attempted to bend forward beyond forty-five degrees. Bending backward or hyperextension was limited and painful and pain was described as being more acute on the left side of the low back about two inches above the top of the pelvis. Lateral motion was somewhat painful but not nearly so limited as hyperextension. Rotation of the back was slightly painful.

Palpation of the back, and by that I mean simply feeling the muscles and striking various points lightly, brought out the fact that there was localized tenderness over the area on the left side that we described and found when bending the patient forward and backward. Striking the area lightly caused the patient to wince and to complain of pain which ran down the leg to the foot. Compression of the jugular veins in the neck region gave an equivocal result. The patient couldn't be sure that he felt any added or diminished pain from the maneuver. In many cases such compression raises the intra-spinal pressure so that pain from an intra-spinal lesion may be aggravated.

The patient was then placed on his back on the examining table and his right leg was elevated slowly. I was able to elevate the leg to almost 90° before the patient complained of some pain on the left side. The left leg was then elevated and the patient complained of pain which became severe when he had elevated the leg only ten inches or 30° from the table. This is the Lasegue's sign, which simply indicates the presence of spasm of the hamstring muscles, usually secondary to irritation of branches of the sciatic nerve supplying those muscles. It may also be an indication of local irritation of the hamstring muscles by inflammatory process, tumor, or other lesions. The straight leg raising test or the Lasegue test is the most sensitive one. Where one of the nerve roots which is already under tension, as in the case of ruptured disc or other intra-spinal lesion, the act of raising the leg places the nerve roots of the sciatic nerve under even greater tension, and it is possible to reproduce the radiation of leg pain about which the patient complains. If the foot is forced upward at the ankle joint, the reproduced pain may become even more exaggerated.

Many other leg tests are performed such as the Gaenslen,[5] the Fabere, the Ely, and so on. They are of more academic interest than

5. Bradford & Spurling, *The Intervertebral Disc*, C. B. Mosby-Publisher.

they are necessary, so far as diagnosis is concerned. The legs are measured and our patient revealed no shortening. Difference in leg length can give rise to mechanical stress and strain in the low back and may be a factor in causing low back pain. Chest expansion was checked and there was no abnormality demonstrated there. A limitation of such expansion could indicate the presence of a crippling type of arthritis.

We next measured the circumference of the thighs, the knees, and the calves to determine whether or not there was any atrophy or loss of size. I found none in this patient. Using a sharp needle we determined whether there were any areas on either the right or left legs where there was loss of sensation, increase of sensation, or inability to feel or differentiate between sharp and dull. We could find no evidence of any diminution of sensation or any hyperesthesia, (increased sensitivity to sensation). In some patients it is possible by marking the areas in which anesthesia, or loss of sensation is present, to draw a pattern from which it is possible to pinpoint the spinal nerve which is involved and is irritated. Each spinal nerve supplies the sensation to a specific area of the thigh and leg and by such pinpointing maneuvers, the pathology can be localized within a relatively small area.

The reflexes are tested both in the knee and ankle. An absent knee jerk or reflex may indicate pathology in the region of the third or fourth lumbar nerve. An absent ankle reflex may indicate pathology in the region of the fifth lumbar or first sacral nerve. Reflexes on our patient were normal.

Next we examined for loss of muscle strength in and about the foot and ankle. Our patient demonstrated no weakness and we were able to assure ourselves that there was no longstanding intraspinal lesion present. A lesion of recent origin, though, could well be present since it requires sometimes weeks or months before evidence of muscle weakness or reflex change becomes apparent.

Part of the physical examination was repeated particularly in checking the areas of tenderness. The patient whose tenderness is not definitely localized in the same areas on each examination must be scrutinized carefully for functional complaints or malingering.

Dodge, Svien, Camp, and Craig[6] emphasized the importance of careful neurological examination in cases of backache with sciatic pain. During the two year period, January 1947 through December 1949, twelve hundred and forty-two patients were operated upon at the Mayo Clinic for removal of herniated lumbar discs. During the

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same period, the diagnosis of "protruded disc suspect" had been made for an additional twenty-seven patients on the basis of the initial general, orthopedic, neurologic, and x-ray examinations, who were found to actually have tumors of the spinal cord. Of this group of twenty-seven patients, there were twelve who had no sensory, motor, reflex, or sphincter disturbances. No examination of the low back is complete until or unless a fairly complete neurologic examination is done. Such an examination need not be done by a neurologist but can be and often is done by the examining orthopedist, neurosurgeon, or family physician.

Following the physical examination, complete x-ray examinations of the spinal column, particularly of the low back, are taken. These include views in the antero-posterior, lateral, and oblique directions and often include stereograms or views taken in such a way as to be projected stereoscopically and allow the examining physician to view the plates and obtain a perception of depth which is not available to him in any other type of view. Examination of our patient revealed a loss of the normal lumbar lordosis, or forward convexity, which indicated spasm in the lumbar group of muscles. There was some narrowing between the fourth and fifth lumbar vertebra which suggested the possibility of there being degeneration in the disc or annulus and also suggested the possibility of a protrusion of the disc or nucleus. There were a few osteophytes present on the anterior margins of the third, fourth, and fifth lumbar vertebrae which suggested that our patient had been engaged for a long time in activities which required bending and stress about the ligaments in the area.

Laboratory examination should include determination of values for white blood cells, hemoglobin, and a sedimentation rate together with urinalysis. The sedimentation rate often gives valuable information about the presence of acute infection. Special tests in older patients for Bence-Jones' protein are done if the presence of myeloma or malignancy is suspected. Where there are doubtful findings on the x-ray which are suggestive in some cases of tuberculosis and/or of tumor, it is often necessary to use a technique of needle biopsy in order to obtain material for examination by the pathologist. Laboratory work on our patient revealed no abnormalities.

Before a diagnosis can be made, differential diagnosis or exclusion of certain conditions must be made. The physician must bear in mind that many lesions involving the spinal column may cause backache. Among them, cancer[7] of the pancreas, duodenal ulcers, arth-

7. R. Ghormley, *Clinical Orthopedics,* "Injuries to Low Back", Volume 1.

ritis, mechanical or static disturbances, rheumatoid arthritis, coccygodynia, or painful coccyx, previous trauma (old fracture), spondylolisthesis, or a slipping forward of one vertebra on another due to a congenital defect, scoliosis, or curvature of the spine, metastatic cancer, fibrositis, or inflammation of the deep muscles and ligaments, gynecologic diseases in women involving the uterus and ovaries, and in men the genito-urinary tract, which include the bladder and the ureters which carry the toxic products from the kidney to the bladder, and a host of other diseases which are responsible to a lesser degree for a type of pain which is often difficult to differentiate from that caused by the ruptured disc. A careful evaluation of our physical findings, x-ray findings, laboratory results, and a partial re-examination of the patient led us to the conclusion that he had a ruptured inter-vertebral disc of recent origin. Since fifty per cent or more of these patients respond to conservative treatment, such treatment was recommended in this case. The patient was put to bed in Fowler's position which simply allows the patient to almost sit up in bed with the knees flexed or drawn up to about thirty degrees or in a partial S position. Most patients with ruptured discs will assume that position because they find it the only one which allows them to rest comfortably. Traction, or the application of weights to the affected leg, may be used. Wet heat is applied to the back at varying intervals during the day and the patient is given sedatives as he requires them. Muscle relaxants are also provided and the patient is checked daily to note any improvement or lack of improvement from the treatment. Our patient was kept in this position and under this form of therapy for about ten days when it was noted that his ankle reflexes on the left side were diminished and that there appeared to be some loss of sensation over the outer side of the leg and over the large toe. Straight leg raising was painful and the leg could only now be raised about six inches off the bed before pain became very severe. The muscles of the back were still in spasm and the patient was extremely uncomfortable. Arrangements were made for an exploratory operation the following morning.

At operation, an incision was made over the spinous processes, or protrusion of bony spines from the vertebra, and the nerve root and disc were exposed. The root was found to be tight at the region of the fourth spinal root and the disc was found to be ruptured on the left side.

If our patient had responded to conservative treatment, he would have been sent home for a period of several weeks during which

time he would have done graduated exercises, and then returned to his former employment. Where the findings are equivocal and it is difficult to make a diagnosis, a myelogram is usually recommended. In this procedure, about five cubic centimeters of a radio opaque oil (pantopaque, an oil which casts a shadow on x-ray examination) is injected into the spinal canal between the fourth and fifth lumbar vertebrae. The patient is placed on a tilt table and his position is changed several times, first with his head down, then with his feet down. The heavy oil migrates upward and downward with the change of position. If there is a block to the passage of oil, it can be recorded on an x-ray film which is taken after each change of position. Unfortunately, this procedure is accurate in only about eighty per cent in cases in which it is used. Twenty per cent of the patients on whom no block is shown may demonstrate, on operation, an actual rupture of the disc. Conversely, some patients on whom a block is demonstrated by x-ray do not have ruptured discs or other demonstrable pathology. Positive proof of a ruptured disc can be made only by operation.

Our patient made, what is termed, an uneventful recovery. This means that he was miserable for about three days after the operation and that he had to be catheterized before he could empty his bladder eight hours after the surgical procedure. The latter is a frequent complication following the use of spinal anesthesia. After eight days of recumbency, the patient was allowed bathroom privileges and moderate ambulation. A back brace was fitted and after a trial of increasing ambulation and the institution of light exercises particularly for the abdominal muscles, the patient was allowed to return home. Activity at home was extremely mild and after four to five weeks the patient was returned to the office where he was re-examined in exactly the same manner as before his surgery.

There were no further complaints of pain on coughing or sneezing, motion in every direction was normal and painless. Reflexes were normal, x-rays showed restoration of the normal lumbar curve but the narrowing between the fourth and fifth lumbar vertebrae was still present. An incidental finding was the presence of a small amount of the pantopaque or radio-opaque oil. It is customary to remove as much of the oil as possible but often a small amount remains. Some authorities claim the residual oil may be responsible for arachnoiditis or scarring about the nerve roots. Others have demonstrated particles of the oil in the brain and have attributed headaches to its presence. The use of oil, where absolutely necessary, makes available to us

a valuable diagnostic aid and allows us to operate at exactly the correct level in most of the cases. The routine use of oil injection, however, as a shortcut to diagnosis is roundly condemned by many leading surgeons.

Our patient returned to his regular work four months after he left the hospital. Six months following the operation, he returned for an evaluation of his permanent disability, if any. Again, a complete physical examination was done and the patient was questioned carefully about his ability to carry on his work, as to whether or not he had fatigue or pain after standing for several hours, or had he noticed any stiffness in his back which might suggest some increasing arthritis. Our patient told us he was very happy with his operation but that he did notice that he fatigued a little more easily and that he was conscious of his inability to lift quite as much without discomfort as he could formerly. X-rays demonstrated a further diminution in the space between the fourth and fifth lumbar vertebrae and the spurring or osteophyte formation seemed to be a little more prominent. The patient was given a rating of 15% permanent partial disability so far as the use of his back was concerned. This represents a fairly rough estimate of the percentage of difference in ability to carry on his work as compared to his condition before the attack.

After the evaluation process, the results of the examination were sent to the insurance carrier and to the Industrial Commission. I was called by an attorney who asked me if I would be willing to testify as to the patient's disability and he further requested a complete report on the patient's injury, operation, and convalescence. A release, signed by the patient, was sent to me and the lawyer was sent his report in detail.

The insurance company requested that one of their physicians examine the patient and when this was done, the report of no permanent disability being present, threw the issue into conflict. Litigation was undertaken and the legal machinery began moving at a speed which the average surgeon would find maddening in a hospital. The attorney for the plaintiff stated to me frankly that the results in this case, just as in 80% of all personal injury cases, depended on medical considerations. If I could brief him on the fundamental problems underlying the whole picture of the ruptured disc, he in return would prepare me for the ordeal of cross examination in the courtroom. Further, he promised to do all in his power to see to it that I wasted no time in the courtroom, that my fee would be protected, and that I would be compensated for the time that I gave to him. I was con-

vinced that if I did not help my patient obtain a just judgment, that I would be derelict in my duty. A three hour meeting was arranged one evening and the lawyer was made aware of the anatomy, the cause, the diagnosis, the treatment, and of the latest studies and reports available on the subject of the ruptured disc. He was taught correct pronunciation and was given an analysis of several hypothetical situations which he presented. I, in return, was instructed in the manner of correctly giving my qualifications and was made to understand that modesty had no place in the courtroom when a medical witness is asked to recite his contributions and his high position in the medical field. I was warned, "don't be pompous, facetious, or angry. Stick to the facts, give honest opinions, and bring your records with you, so that you can refer to them when the need arises. Talk to the jury in language they can understand and answer all questions to the best of your ability. Don't lecture and always tell the truth even if it hurts." A statement by a prominent plaintiff's attorney, Mr. Emile Z. Berman, was given to me so that I might better understand the problems involved in a medical-legal action. Mr. Berman's statement presents a facet of litigation with which most doctors are not at all familiar. "Whatever side a lawyer espouses, unlike a doctor, he espouses as an advocate in a forum where the contests are bitter. However, bear in mind that the medical controversies which are brought into the courtroom are not created by lawyers. The present state of medicine has not yet resolved the great controversies involved in cause and effect, and these controversies find their reflection in the courtroom itself. As an advocate, counsel is entitled and has a duty to bring to his client's cause everything that medical science and opinion can establish in his favor, whether it be a minority or majority view. Controversies in the field of medicine are so broad and the literature for either side so abundant, that the advocate who tries these causes must himself laboriously delve into theory and literature, taking from the medical profession and its writers what they have to offer in a field of medical-legal practice."

My appearance in court was a pleasant experience instead of the nightmare that most physicians had led me to believe it was going to be. I was thrilled when the defendant's attorney on cross examination asked me how much I was being paid to testify. I had anticipated the question and I answered, "I am not paid to testify. I am merely paid for my time away from the office." And so I was. Had I not been prepared, some of the questions on cross examination might have nettled me. For instance, "Doctor, how many times had you

testified for the plaintiff's attorney?" "Doctor, how much do you charge for a lecture such as you gave the jury?" Throughout the proceeding, I was able to maintain a dignified poise and I was certain that after I left the witness chair, that the jurors had the impression that I was unbiased and that I had testified only as to the truth. I had sincerely tried to explain difficult medical terms to the jury so as to avoid confusion and had answered many questions that the bench had put to me so that the judge, too, could better understand the problems. When the judge later remarked about the clarity of testimony, I felt that it was a distinct tribute to the attorney who had made a special effort to really understand the problem of his client and who had gone to a great deal of trouble to help me, in turn, to understand some of the problems inherent in the courtroom. It is not too difficult to understand how, in a condition as complex and one in which knowledge is still inexact, that injustice might result when such a case comes to litigation. Where experts are not available, a dishonest physician in league with a dishonest lawyer can point out non-existent pathology on x-rays and convince a jury by sheer histrionic ability that a large judgment is justified. As a physician, despite the fact that I have been treated fairly in court, I would prefer to be a witness for the court. As an honest lawyer, I would prefer to have the services of outstanding medical men who would not be adverse, to appear in court as members of impartial medical panels. Cooperation between medicine and law is a necessity if justice is to be done to the hundreds of thousands of personal injury victims who find it necessary to resort to litigation.