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Low-Back Pain: An Orthopedic Medicine Approach

SUMMARY

Many patients suffering from low-back pain present to a family physician. This paper will deal specifically with the moving parts of the lumbar spine as the source of low-back pain: muscles, discs, ligaments, apophysial (facet) joints. A detailed systematic approach is suggested to facilitate the identification of the particular tissues involved. Various modes of treatment—manipulations, tractions, epidural injections and sclerotherapy—are discussed. (*Can Fam Physician* 1987; 33:689–694.)

SOMMAIRE

Le médecin de famille doit fréquemment s'occuper de patients souffrant de douleurs lombaires. Cet article traitera particulièrement des éléments mobiles de la colonne: les muscles, les disques, les ligaments et les facettes articulaires. Une approche systématique est suggérée afin de faciliter l'identification des tissus lésés. Les différentes modalités de traitements présentées sont la manipulation, la traction, l'injection épidurale et la sclérothérapie.

Key words: diagnosis, moving parts, low-back pain

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LOW-BACK PAIN is one of the common presenting complaints in the office of a family physician.¹ The financial burden that low-back pain places on Canada's health-care system, insurance companies, employers, the Workers' Compensation

Board, and on the patients themselves needs no lengthy description. Neither does the frustration that a family physician often experiences when she or he has to deal with a patient with low-back pain.

The question that arises in dealing with such patients is, "What should be done with a patient whose x-rays and lab tests are normal, but who still has pain after the usual advice has been implemented?" The crux of the problem is that after ruling out pain arising from lesions in the bone (Table 1) and pain referred to the back from the retroperitoneal structures (Table 2), it is imperative to evaluate which of the other tissues in the low back could be causing the problem (Table 3).

This paper's goal is to present a

systematic approach for determining which of the moving parts is at fault. Predisposing factors such as a short leg^{2,3} and sacro-iliac dysfunction,^{4,5} which can have a major influence on the moving parts, will not be discussed. Manipulation, traction, epidural injection and sclerotherapy will be the modalities of treatment discussed, and the emphasis will be placed on the question of when to use each of them.

Anatomy and Pathophysiology

A very elementary description of the disc⁶ shows that the outer layer of the disc, the annulus, is formed of many layers of fibrous tissue (Figure 1); the anterior layers are more abundant than the posterior layers. The an-

terior part of the annulus is re-inforced by the anterior longitudinal ligament, which is wide and thick compared to the posterior longitudinal ligament. Thus, the posterior portion of the disc is weaker than the anterior part. The centre of the disc, the nucleus, has a composition of 90% water, which forms a semi-gelatinous structure. If all structures remain intact when the disc is compressed, the pressure in the nucleus is distributed evenly on the walls of the annulus.

With ageing, changes occur in the disc. In the annulus, fissures develop. In the nucleus, the water content decreases, and the amount of collagen fibres increases. Thus the nucleus loses its homogeneous constitution. When the disc is compressed, therefore, the pressure is not distributed evenly on the wall of the annulus. If the nucleus gradually infiltrates the fissures, the annulus (Figure 2) will begin to bulge. When the bulging of the disc is caused by the nucleus, it is called a 'soft disc protrusion'. When, on the other hand, the bulging of the disc is caused by part of the annulus, it is referred to as a 'hard disc protrusion' (Figure 3). The distinction between hard and soft disc protrusions is extremely important in determining

which modality of treatment should be used. By the time a patient reaches age 60, the nucleus is nearly all absent, and hard disc protrusion is the rule.

The disc can shift in different directions (Figure 4), but the posterior shift is of clinical importance. The disc can shift directly in the posterior direction, producing a central protrusion. If pressure is exerted on the posterior longitudinal ligament, its clinical manifestation will be a generalized low backache. If the central protrusion increases in size, pressure on the dura mater will begin, and this pressure will be reflected clinically by an increase in low-back pain, which is often called 'lumbago'. If the disc moves even more in a posterior direction, the cauda equina is compressed, and the result is an S4 palsy. This is a massive central protrusion presenting either with bilateral sciatica, bladder symptoms and/or bowel symptoms, and perineal paresthesia. Here we have a surgical emergency.

Because the posterior longitudinal ligament is narrow, the disc has a tendency to bulge on one side or the other of the posterior longitudinal ligament. Such a condition is referred to as a 'postero-lateral protrusion'. This protrusion presents in three forms (see Table 7), depending on the amount of pressure exerted by the disc. The pressure is first exerted on the dural sleeve, which is an extension of the dura mater and covers the proximal end of the nerve root. When pressure is exerted on the dural sleeve, it produces leg pain which follows the distribution of the dermatome involved. This is commonly called 'sciatica'. With the appearance of leg pain, there is a decrease in low-back pain because of a decrease in pressure on the dura mater. If there is more bulging of the disc, then in addition to the

pain of dural sleeve irritation, the sensation of pins and needles, indicative of mild nerve-root compression, will occur. This marks the onset of the second phase. This paresthesia will follow the same dermatomal distribution. If the disc bulges even more, the third phase begins: there is severe nerve-root compression manifested clinically by a neurological deficit; that is, sensory and/or motor and reflex changes will occur. The disc, therefore, may shift in different directions as described above, giving rise to low-back pain, lumbago and sciatica as the progression of the same pathology. It is a shifting lesion in the intervertebral joint, and the site of the pain changes depending on which tissue is irritated. This condition is similar to a renal calculus, where the pain is felt in the flank or the groin depending on whether the calculus is in the kidney or is migrating down the ureter.

It is obvious that obtaining the patient's history in chronological order is vital. If, for example, sciatica appears and backache increases, extreme care is necessary. The cause is usually not a shifting lesion in the intervertebral joint; rather it could be an expanding lesion. Similarly, paresthesia appearing in the leg before the pain should also be a warning sign.

History

Looking at Nackemson's work (Figure 5) as he measured the intradiscal pressure in different positions,⁷ we can see that the least amount of pressure exists in the disc when the body is in the supine position. The pressure increases with the standing position and is even greater with the sitting position. If forward flexion is added to the standing and sitting positions, the intradiscal pressure is

Table 1
Bone Pain

Trauma:	fracture
Infection:	osteomyelitis
Neoplasm:	primary (e.g., myeloma) secondary
Metabolic:	osteoporosis, osteomalacia Paget's Disease

Table 2
Referred Pain

Aorta	Bladder
Pancreas	Rectum
Kidney	Stomach
Prostate	Uterus

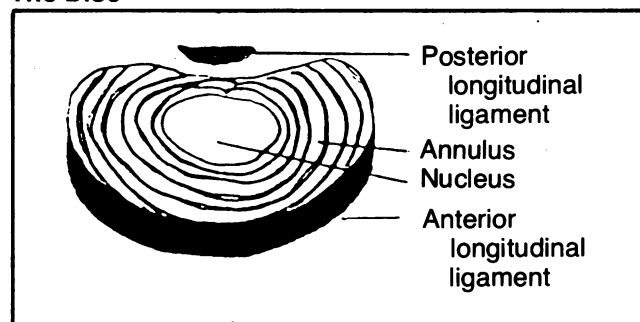
Table 3
Moving Parts

Discs
Ligaments
Muscles
Apophysial (facet) joints

Table 4
Intensity of Pain

Morning Lying	<	Standing	<	End of the day Certain postures Sitting
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Figure 1
The Disc



higher still. If the annulus is intact, the increase in pressure is of no clinical importance. If a patient presents with pain secondary to disc protrusion, one can expect the bulge to increase with increased intradiscal pressure. This condition presents clinically as an increase in low-back pain in a central protrusion and an increase in leg pain and/or paresthesia in a postero-lateral protrusion. The first result of this is an increase in low-back pain in a central protrusion; the second is an increase in the pain and/or paresthesia in the leg in a postero-lateral protrusion.

A typical case history (Table 4) shows that the patient suffers least pain in the morning. The reason for this is that the patient has been in the supine position all night, which is the position of least intradiscal pressure: the bulging would therefore decrease, resulting in less pressure on the sensitive tissues. The pain would increase during the day, depending on the patient's activities, and the patient is usually well aware of this. The more forward bending and sitting the patient does, the more pain he or she will experience. The pain is usually worse at the end of the day. As the degree of pain is related to different activities, the patient can control the pain to some extent. The patient who is very careful about posture and activities.

When the physician is evaluating the moving parts, the patient's history is again very important to make the diagnosis of ligamentous insufficiency. The pain caused by ligamentous insufficiency can derive from two mechanisms. It can be caused by recurring articular derangements which occur as a result of loose ligaments that do not maintain the structures in proper position and allow abnormal movements in the

intervertebral joint, as seen in recurrent lumbar disc syndromes. For example, a patient will be relieved of his low-back pain after manipulation or other modalities of treatments, but this relief is only temporary.

In the second mechanism, the pain arises from the ligaments themselves; it is a pure ligament-strain pain with no displacement. These patients will present with the "Theatre-Cocktail Party Syndrome", as described by Barbor.^{9, 10} that is, the patient will say that she or he cannot remain in the same posture for too long. After a certain amount of time in the same posture, the weak fibres in the ligaments will yield on tension and permit excess pull on the non-stretchable nerve endings, thus producing pain. The pain will worsen, and the patient will need to change posture in order to be relieved. The change of posture shifts the tension to another group of ligaments. These patients cannot stand too long at a cocktail party, nor can they sit too long at the theatre. They must change posture all the time. Thus, the name "Theatre-Cocktail Party Syndrome". Even when lying down at night, these patients have to change posture frequently, and in the morning they complain of stiffness for varying periods of time. As the patient moves around, the pain gradually decreases. This last symptom shows close similarities to the history of patients with inflammation of the apophysial (facet) joints, such as ankylosing spondylitis.¹¹ A distinction exists, however, between the two conditions: patients with ligamentous insufficiency do not get better as the day goes on, as do patients suffering from ankylosing spondylitis. At night, when they sit down to relax, the pain will not allow them to remain sitting for too long; they must continually shift and change posture. The more

severe the laxity, the more quickly the pain will appear, and the more often the patient must shift position.

The fourth moving part, the muscle, may be the origin of low-back pain. Here the physical examination is of greater help to the diagnosing physician than is the patient's history.

The history, however, is the first tool that will help the physician identify the cause of low-back pain. What must be determined is the way the pain is behaving: Is the pain very dependent on what is going on in the way of movement (i.e., moving parts), or is the pain independent of the patient's activities (i.e., referred pain, bone pain)?

Physical Examination

When the case history points towards the moving parts, the physical examination can further identify which of the moving parts are involved. One method of physical diagnosis which is very simple and most useful is the "technique of selective tissue tension" developed by the late Dr. James Cyriax.^{10, 12}

The main concern of the physician examining the lumbar spine is the patient's movements. These are represented in Robert Maigne's diagram (Figure 6). The patient is asked to do the movements of forward flexion, both-side flexions, and extension. There is very little rotation at the lumbar spine. Following the active movements, the patient should attempt resisted movements: that is, the patient is asked to repeat the same movements, while the physician tries to prevent or resist them.

If the lesion is in a muscle, that muscle, contracting against resistance (isometrics), will be really painful and will reproduce the patient's pain. The active movements may be painful and

Figure 2
Soft Disc

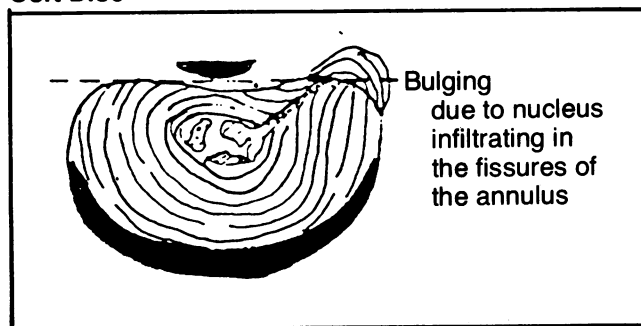
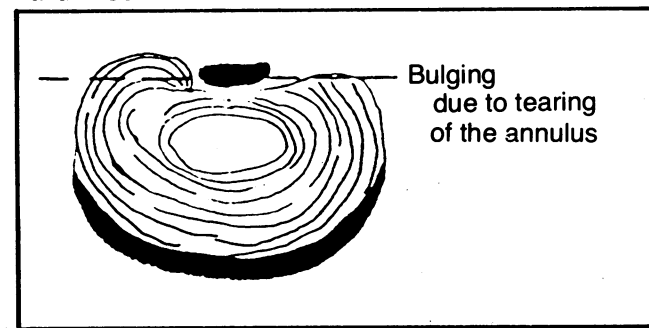


Figure 3
Hard Disc



reproduce some of the pain, but that discomfort will be nothing as compared to the pain of the resisted movements (Table 5).

If a ligament, such as the supraspinous, is a source of pain, another typical pattern is produced. Active movement in one direction will stretch this ligament and reproduce the pain. All other active and resisted movements will be pain free (Table 5).

A completely different situation arises if an irritation in the apophysial

(facet) joint is present. Take, for example, a specific joint condition, rheumatoid arthritis. If a person suffers with inflammation of a synovial joint, the capsule of those joints, where the sensory nerve endings are, is going to be stretched in whichever direction the joint moves. All movements will hurt, and this is what is called a full articular pattern. This response will be seen in people with any type of inflammation involving any joints.

With a disc, the situation is dif-

ferent again. In almost every case, the disc will prolapse a little to one side or the other of the midline because the posterior longitudinal ligament is narrow. Typically, the patient does not like to bend to one side because this movement increases the pressure on the sensitive tissues. Figure 7 shows that if there is an axillary protrusion on the left side, side flexion to the right will increase the pressure on the dural sleeve and nerve root, and thus increase the pain and/or paresthesia. Side-bending to the painful side will decrease the pain. If the protrusion is lateral to the nerve root on the left side (Figure 8), then side-bending to the left will increase the pressure on the sensitive tissues and increase the symptoms, while side-bending to the opposite side will decrease the symptoms. This explains the antalgic posture. When some movements increase the pain and others do not, the term 'partial articular pattern' is used to describe the condition (Table 5), as distinguished from full articular pattern when all movements hurt.

Examination of the lumbar spine for these patterns is, therefore, a very useful starting point. When the technique of selective tissue tension is used, the aim is to determine which movement(s) reproduce(s) the patient's pain. If "everything" hurts, that is, all active and all resisted movements, then it is most likely either that a serious illness such as metastasis exists, which can be easily diagnosed by further investigation, or that the pain is not organic in origin.

In a slight disc protrusion, a partial articular pattern is found. If the disc bulges a little more and there is pressure on the dura mater, the articular signs will be more pronounced as a result of a bigger displacement in the intervertebral joint; the movements are therefore more limited and painful. In addition, signs of decreased

Figure 4
Anatomy of Disc Prolapse

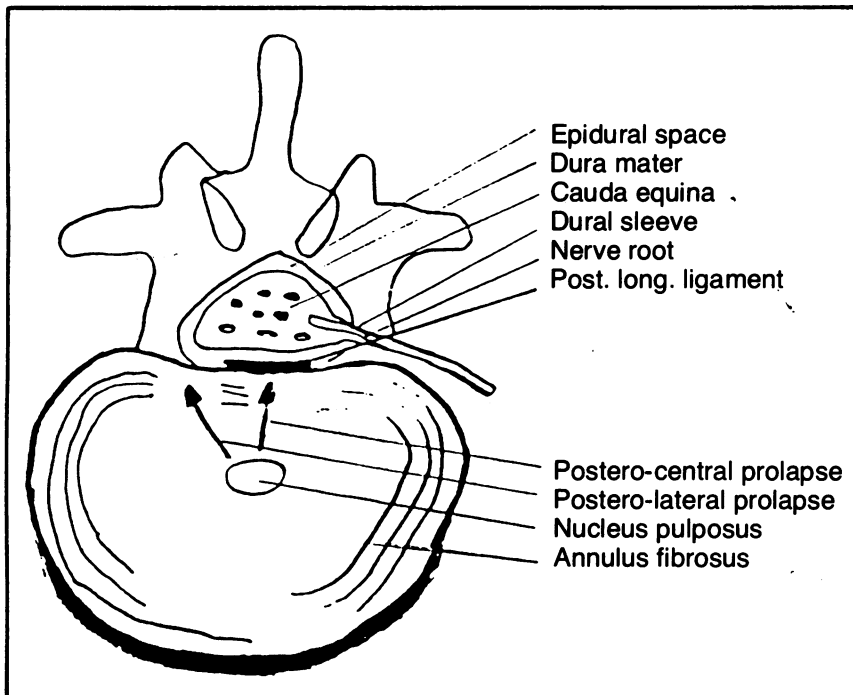


Figure 5
Measurement of Intradiscal Pressure in Different Positions

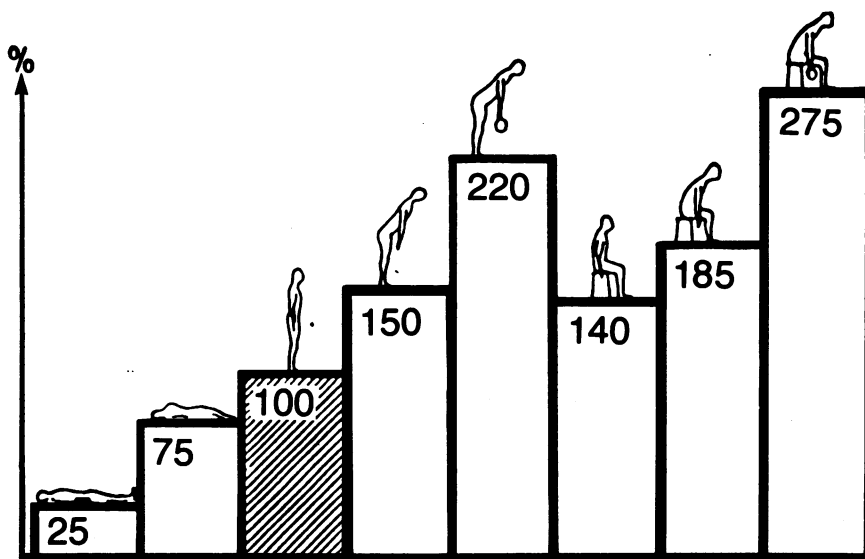
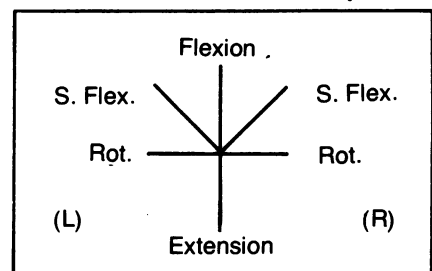


Figure 6
Patient's Movements During Examination of the Lumbar Spine



mobility of the dura mater, the dural signs (Table 6), may be present. Straight-leg raising will be limited and painful if there is impingement of the nerve root L-4 to S-2. The reverse straight-leg raising, that is, the L-3 stretch, will reproduce the low-back pain if there is an impingement on the L-3 nerve root. Coughing and/or sneezing may also increase the pain. If the disc bulges more laterally towards the nerve root, in addition to the articular signs and the dural sign, the root signs (Table 7) appear.

Thus, from the history where the patient says "I have pain, but it depends on what I do", and from a physical examination with articular signs, with or without dural and/or root signs, it becomes evident that the physician is dealing with a lumbar disc syndrome.

To diagnose ligamentous laxity as the source of pain on the basis of the examination, in addition to noting the movements of the lumbar spine that will show that one active movement reproduces or increases the pain, the physician can stress the different ligaments in an attempt to reproduce or increase the pain.¹³ Thirdly, the physician may palpate each ligament for trigger points,^{14, 15} and needling¹⁴ will confirm the diagnosis.

Therapy

Different modalities can be used in the treatment of low-back pain. The

Table 5
Back Pain
from the Moving Parts

	Pain Increased by Movement	
	Active	Resisted
Muscle	+/-	++
Ligament	One	—
Joint	All	—
Disc	Some	—

Table 6
Dural Signs

SLR (L4-S2)	
L3 stretch	
Coughing	
Sneezing	

Table 7
Root Signs: Three Phases

Dural sleeve irritation
Dural sleeve irritation + mild nerve root compression
Severe nerve root compression

important point to know is when to use a specific modality.

Manipulation

Manipulation is indicated when there is first of all a history of sudden onset of low-back pain (i.e., hard disc), and, secondly, if physical examination discloses a partial articular pattern and the pain is increased by side flexion away from the painful side (i.e., small axillary displacement, Figure 7). If, on the other hand, there is a history of sudden onset of low-back pain (i.e., hard disc) and if the physical examination still shows a partial articular pattern, but side-flexion towards the painful side (i.e., large

displacement lateral to the nerve root, Figure 8) increases the pain, the results of manipulation cannot be expected to be as effective. Manipulation works best for a small hard displacement in the intervertebral joint. In this situation, reduction of the herniated disc is often immediate, and the patient leaves the office symptom free.

Traction

Traction is indicated when there is a history of gradual onset of low-back pain (i.e., soft disc). It takes time for the nucleus to infiltrate the fissures of the nucleus. This semigelatinous infiltration cannot be manipulated back in place as can a portion of the annulus.

Figure 7
Small Axillary Displacement

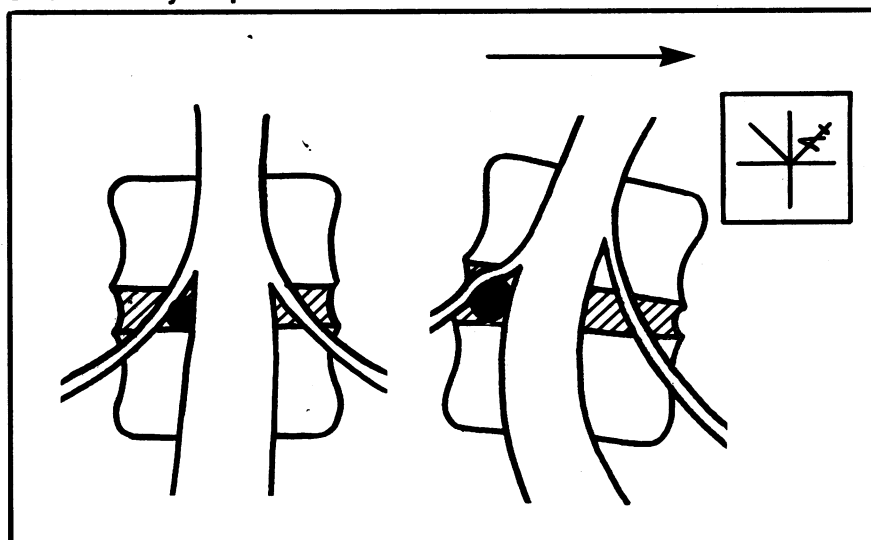
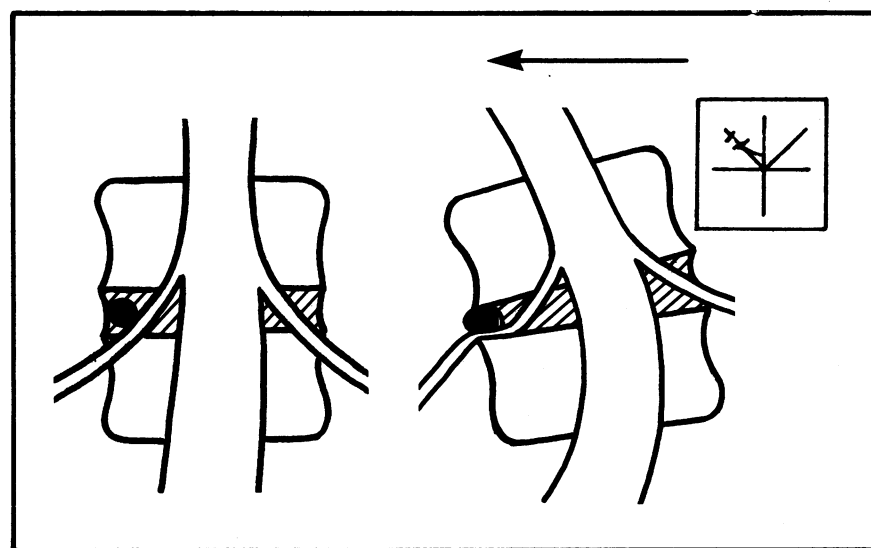


Figure 8
Large Displacement
Lateral to the Nerve Root



Reduction of the herniated disc is then best done by using lumbar traction with a force of half to two-thirds of body weight.¹² This distraction allows the vertebrae to separate, thus creating a negative pressure in the intervertebral joint. The nucleus, which is infiltrated in the fissure, is drawn by suction into its proper place. Traction is applied daily for half an hour, after which the patient can return to normal activities. After two weeks of therapy, the reduction of the herniated disc is usually complete. Bed rest would accomplish the same therapeutic results, but who can stay in bed longer than 24 hours?

Epidural injections

Epidural injections^{12, 16} with 50 cc of 0.5% of procaine, via the sacral hiatus, are indicated when manipulation and/or traction has failed to reduce the protrusion or has not been indicated. An epidural injection is the treatment of choice with an hyperacute lumbago where manipulation and traction cannot be performed because the slightest movement is too painful. Epidural injections are also indicated in the presence of a neurological deficit. In this situation, the protrusion projects so much postero-laterally that usually neither manipulation nor traction will have a beneficial effect. In this situation, the patient is observed closely, and if the neurological deficit increases or does not improve after two or three epidural injections at weekly intervals, the question of surgery is introduced. In chronic and recurrent lumbar disc syndrome, cortisone is added to the treatment for better results.^{17, 18}

Sclerotherapy

For the most part sclerotherapy is indicated in chronic cases of low-back pain secondary to ligamentous laxity: that is, when there is a history of easy

recurrence of low-back pain and/or of the theatre-cocktail party syndrome. It is also indicated if physical examination shows that one active movement or the stressing of the ligaments increases or reproduces the pain. Trigger points are also found on palpation of individual ligaments,^{9, 14, 15, 19} and needling¹⁴ reproduces the pain.

Conclusions

The moving parts of the low back are the most common cause of low-back pain seen in the office of a family physician. Many modalities of treatment are available, but none of them should be used before the tissue at fault is known and the type of lesion to be dealt with is identified.

A basic principle in medicine is first of all to make a proper diagnosis; secondly, to select the appropriate modality which will have an effective therapeutic result. The physician should not modify this important rule when treating low-back pain. ●

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