



## Examination Of The Patient With Low Back Pain

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If one performs a careful and thorough examination of the low back, he or she can expect to get the correct diagnosis. Excluding referred back pain caused by the distant pathology such as renal colic; the majority of back pain has mechanical origins, arising with about equal frequency from the intervertebral discs and the posterior apophyseal joints.

Structural problems in the spine are most easily appreciated when the vertebral column is considered as a series of motion segments (1). Each segment consists of 2 vertebrae, the intervening disc, and the interlocking posterior joints. Pathology in one part of the segment should always be considered in relation to the other components (2). Although several sites may be involved, one area is usually more painful than another and this painful site can be detected by physical examination.

The diagnosis of low back pain is not always easy. Both disc and facet problems may be complicated by painful paraspinal muscle spasm that can produce referred leg pain (3,4). Although the diagnosis is repeatedly emphasized, relatively few patients have nerve root compression (5,6).

Throughout the low back examination, assessment of the central nervous system should be considered in 2 categories: tests of nerve root irritation and tests of nerve conduction. Considering these components separately can aid the examiner in correctly diagnosing the common but frequently overlooked discogenic back pain with nerve root irritation when localizing signs from loss of nerve function are absent.

## **The History**

The examination begins with a complete history. Properly obtained, the patient's story alone often suggests the diagnosis (7). For example, occupational activities can offer important clues in some patients (8).

Question the patient regarding the onset of pain. Sudden attacks, typical of facet joint involvement, should be differentiated from the steadily increasing pain more common with disc lesions. When there is a history of trauma, the exact mechanism of injury should be noted.

Back pain is generally recurrent rather than continuous. Determine the pattern of attacks as well as the frequency and duration of a typical episode. Acute attacks lasting a few days separated by periods of complete freedom from the pain are common with pathology in the facet joints. Discogenic pain tends to be longer lasting, with the acute episode extending over several weeks followed by months of continuing discomfort.

Note the location and relative severity of pain in the back, buttock, or leg. Pain from the discs or posterior apophyseal joints tends to be severe in the back, buttocks, or posterior thighs. Pain from the nerve root irritation tends to occur primarily in the leg and radiate distally. Pain, as distinct from parasthesia, radiating into the toes is almost always diagnostic of direct nerve involvement.

Because pain is a subjective experience, the actual amount may be difficult to determine. The patient's medication record may be helpful in acute cases, but chronic back pain sufferers are sometimes subject to drug overuse, and their medication history often reflects a chronic pain syndrome rather than ongoing pathology in the spine. Furthermore, disability cannot be equated with the patient's subjective sensation of pain. Some occupations aggravate back pain, resulting in disability from relatively minor symptoms. Since successful treatment implies the restoration of the patient's normal lifestyle, treatment goals should usually be dictated by the amount of functional impairment rather than the patient's description of the pain.

Factors that aggravate or relieve the symptoms should be listed. Pain that occurs on forward bending, is aggravated by rotation, or is intensified when the patient stands still or sits bent forward is usually discogenic. Pain accentuated by back extension generally arises in the posterior joint and ligament complex. When there is an adequate blood supply in the lower limbs, symptoms of pain or heaviness in the legs after walking that are relieved by a short period of rest (particularly rest in a specific position) often reflect a cauda equina claudication secondary to spinal stenosis. In most cases of mechanical back pain, bed rest will reduce or eliminate the symptoms, and even pain from direct root irritation can usually be controlled. Failure of 2 weeks on complete bed rest to substantially diminish the pain is an indication for further investigation.

Always inquire about the effect of previous therapy. Record the period between the onset of pain and the initiation of therapy, the nature of the treatments including their frequency and duration, and the patient's response. Determine the time between your assessment and the patient's last treatment and whether the symptoms have changed. The judicious repetition of a previously "ineffective" treatment may be beneficial. Traction for an acute soft-tissue tear is useless; traction to relieve spasm in healed muscle may produce dramatic relief.

## The Physical Examination

On completion of the general physical examination, turn your attention to the back. Since examination of the back relies heavily on patient cooperation and many of the manoeuvres may be painful, it is important to examine quickly and without duplication. This series of examinations with the patient in 9 different positions (Figure 1) assesses the musculoskeletal and central nervous systems and the common sites of referred back pain. A separate examination of each area is impractical. By following this approach, under optimal conditions, a thorough physical assessment is possible in less than 5 minutes (9).

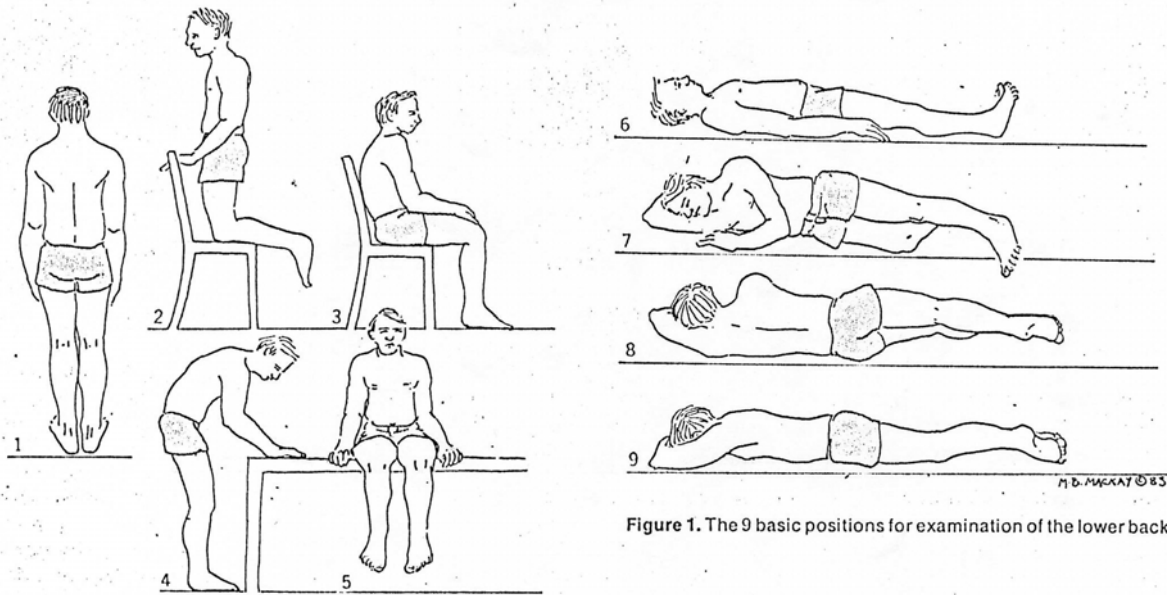


Figure 1. The 9 basic positions for examination of the lower back.

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### Position 1: standing

With the patient standing, inspect the back for scoliosis and other posture deformities. Ask the patient to bend forward at the waist while keeping the knees straight; observe both range of movement and the patient's reaction. Have the patient repeat 3 times. Increase pain on repetitive forward bending is common in symptomatic disc pathology.

Note range of motion in relation to some reference point such as the distance of the fingertips from the floor. (Precise measurement is unnecessary since minor variations are of no diagnostic significance.) The range of flexion should be compared with the expected normal range or with findings on serial examinations.

Instruct the patient to straighten up slowly and to continue to arch the back so as to look upward. Normally, extension begins in the low back and moves smoothly up the spine, with most of the movement occurring in the lumbar area. Patients with back pain may fix the lower back, bend the knees, and straighten through the hips to reduce the irritation of a painful motion segment. Pain on extension past the erect position indicates a problem in the posterior elements.

To examine lateral bending, have the patient bend at the waist to each side. Rotation of the spine is performed while the examiner hold the patient's pelvis against movement. Note the range of motion and pain production with each manoeuvre (10).

An excellent test to uncover functional problems can be performed in conjunction with spinal rotation (11). With the patient's arms at the sides and hands held against the greater trochanters, passively twist the patient's torso by pushing and pulling on opposite sides of the pelvis. With the arms held down, the shoulders and hips maintain a fixed relationship to each other and the spine remains immobile. The first 30-degree of rotation occurs entirely through the hip joints. When back pain is elicited with this manoeuvre, a psychogenic response is indicated (Figure 2).

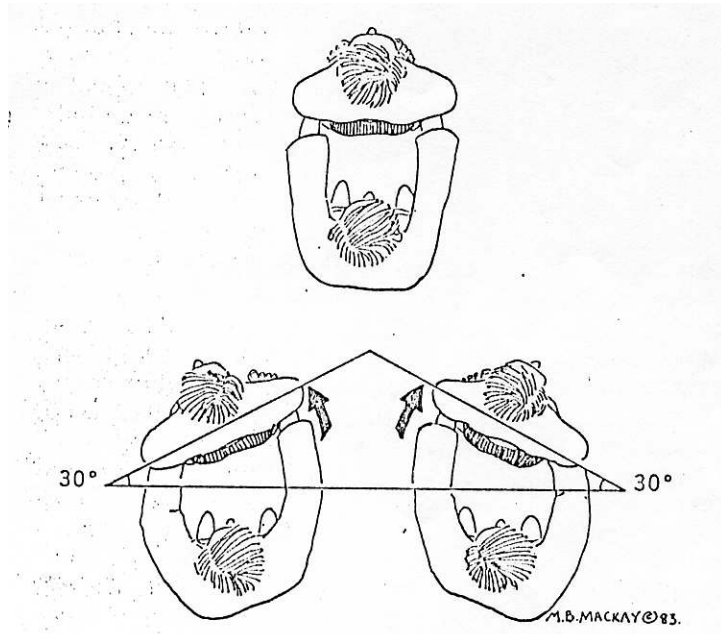


Figure 2.

Illustration of overhead view of physician – patient manoeuvre for testing psychogenic pain. Such pain often occurs with the first few degrees of movement. Ensure that the patient's hands are tightly held against the hips to avoid spine rotation.

With the patient still standing, examine the central nervous system. Test the power of plantar flexion by having the patient perform 10 toe raises on both feet and 10 more on each foot separately. This fatigues the calf muscles and accentuates minimal differences in strength of muscles predominantly enervated by the first sacral root. (This method is more accurate than the conventional technique in which the supine patient plantar flexes against resistance from the examiner's arm; slight differences in muscle strength cannot be detected.)

The Trendelenburg test can be used to corroborate the test for hip abductor power (see "positions 7 and 8). Weakness in the hip abductors causes the opposite side of the pelvis to fall when the patient stands on the symptomatic leg.

### **Position 2: kneeling**

To test for nerve involvement at the S1 level, have the patient kneel on a chair. This posture accentuates the reflex. Further reinforcement is obtained by having the patient squeeze the back of the chair or plantar flex the ankle against light resistance.

### **Position 3: sitting with feet on the floor**

As in position 2, only the central nervous system is examined in position 3. Have the patient sit on a chair with the heel on the floor and elevate the forefoot against strong downward pressure. (Flexion of the hips and knees while sitting minimizes irritation of the sciatic nerve, which might inhibit movement.) The mechanical advantage achieved by positioning the examiner's upper body above the patient's foot is sufficient to overcome even normal dorsiflexor power, thereby allowing detection of small degrees of weakness in the muscles supplied by L5 (Figure 3).

True muscle weakness is the most reliable indicator of a continuing loss in nerve conduction (12). Sensory changes are subjective, and reflexes lost in a previous episode of nerve root compression rarely return, even in the presence of full motor and sensory recovery (13).

It is important to differentiate between true weakness and voluntary release. When genuinely overpowered, the patient's muscles give way smoothly, and the examiner has the sensation of uniform resistance. Voluntary release occurs in one of 2 ways: some patients will actively and successfully resist for a few moments then suddenly let go, while others will attempt to simulate the gradual release of true weakness. Deliberate relaxation always produces a series of small "cogwheel" steps.

Although establishing the patient's honesty during the examination is important, the discovery of voluntary release does not necessarily exclude organic disease. Patients may feign gross weakness to ensure that the doctor will not overlook a minor degree of real muscle power loss. Unfortunately, the opposite result often occurs: convinced that the patient is dishonest; the examiner completely ignores evidence of genuine pathology.

### **Position 4: bending forward**

While the patient bends over the examining table and supports the weight of the upper body with the arms, palpate the spine. Areas of local tenderness or muscle spasm, soft tissue masses, bony defects, or the presence of scoliosis can readily be detected. Reproduction of pain with lateral pressure on a spinous process suggests segmental instability.

Because of the wide variation in referral patterns, the precise location of the painful areas is of limited diagnostic significance. Fibrocystic nodules along the iliac crests and over the posterosuperior iliac spines are a typical source of confusion (14). Surgical exploration of these small discrete masses has never demonstrated local pathology. Such nodules appear to represent only a painful secondary response, and their exact positions are of no clinical importance.

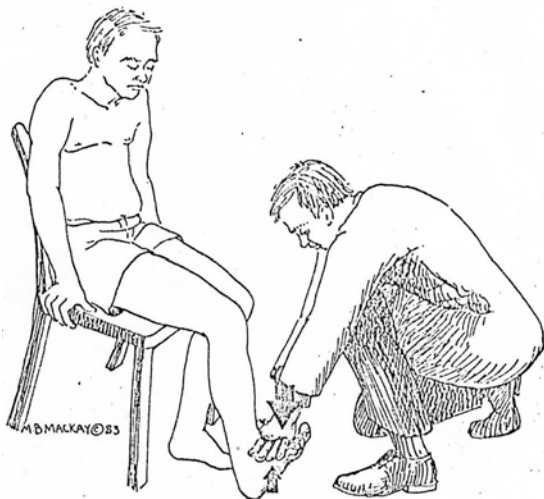


Figure 3.

Maintaining steady downward pressure for up to a minute with overpower the strongest dorsiflexor muscles. (Avoid positioning your fingers under the sole of the foot.)

### **Position 5: sitting with legs hanging free**

Test the knee reflexes as the patient sits on the side of the examining table and tries to pull the locked hands apart just at the moment of hammer strike. Minor asymmetry in the reflex pattern is usually caused by the patient's failure to completely relax the quadriceps or hamstrings. Asymmetric responses are valid only when present on repeat testing.

With the patient still seated, test the plantar reflexes. Spinal cord lesions can occasionally present as pain in the lower back with sciatic distribution. Lower lumbar disc problems with nerve root compression can cause only lower motor neuron lesions. Upper motor neuron involvement indicated by an up going toe places the pathology above the level of the first lumbar vertebra.

By following this approach, under optimal conditions, a thorough physical assessment is possible in less than 5 minutes.

Lifting the leg to stroke the sole of the foot with the patient sitting extends the knee and produces straight leg raising comparable to the format test carried out with patient supine (15) and should produce the same pain response. This manoeuvre is a more accurate assessment of functional magnification than having the patient sit forward with both legs extended. This latter technique may be inhibited by discogenic back pain without root involvement. Furthermore, the unilateral

root impingement, the amount painless straight leg raising may be greater for both legs together than for the affected limb alone.

### **Position 6: lying supine**

Because hip pain is often confused with low back pain, the hip joint can be assessed rapidly in this position. Pain reproduced on flexion or internal rotation of the hip suggests intraarticular pathology and indicates the need for a more complete joint examination. Hip pain tends to be felt in the anterior groin and down the anteromedial thigh to the top of the knee. Conversely, back pain typically radiates to the posterior buttock, greater trochanter, and back of the thigh. Groin pain referred from the back is not unusual, but true hip pain rarely spreads posteriorly.

The classic test of sciatic nerve irritation is passive straight leg raising. The patient lies with one leg flexed at the hip and knee, the sole of the foot on the table. This reduces stretch on the sciatic nerve and, to allow accurate comparison, duplicates the position of the contralateral leg when straight leg raising was tested with the patient sitting. An unequivocally positive result produces pain radiating down the back of the leg with the knees fully extended and hip elevation of 60 degrees or less. Symptoms produced at elevations above 60 degrees may represent nerve root irritation but may also reflect referred mechanical back pain or muscular irritability.

Sciatic nerve irritation also produces pain radiating to the posterior calf or thigh from digital pressure in the midline of the popliteal fossa. A third method of demonstrating sciatic nerve irritation is to dorsiflex the foot while straight leg is held just below the height of the positive response; leg pain indicates sciatic irritability but not necessarily diminished nerve function.

As previously noted, when unilateral root impingement is present, passive double straight leg raising is often painless to a higher elevation than occurs when raising the affected leg by itself. This is due to both the additional movement gained by flexing the lumbar spine and to lack of the contralateral tethering of the nerve roots when both legs are lifted together. When the examination reveals a psychogenetic picture, double leg raising is routinely painful at a lower elevation than the single leg lift. These patients apparently believe if one is bad, 2 should be worse.

The clinical localization of nerve root compression is difficult unless loss of nerve function has occurred. Irritation alone offers few clues. Examine the muscle power of the quadriceps and hamstrings, and record the response to pin-prick over the front of the legs from the L3 to the S1 dermatomes.

“Cross-over” pain is an important but frequently misinterpreted physical finding (16). Typically, with unilateral nerve root impingement, passive straight leg raising of the affected side produces pain in the leg being tested. Cross-over pain occurs down the contralateral asymptomatic leg when the painful limb is raised. Confusion with this test arises because occasionally (in cases of acute unilateral herniation) elevation of the normal leg increases pain on the affected side. This test designated “well leg lifting,” merely demonstrates extreme irritability of the involved nerve root (17). Only pain radiating down the normally pain-free limb can be considered true cross-over pain indicative of a central disc rupture (Figure 4).

Together with cross-over leg pain and the absence of anal sphincter tone, saddle anesthesia forms a diagnostic triad indicative of an acute central disc herniation.

In addition to assessing the hips, an abdominal examination, palpation of the costovertebral angles, a check of the peripheral pulses, and inspection of the lower limbs for vascular insufficiency cover the major causes of referred back pain and complete the examination of the supine patient.

### Position 7 and 8: lying on one side

Have the patient lie first on one side and then on the other, keeping the uppermost leg extended. The power of hip abduction, a predominately L5 function, is tested as the patient elevates the upper leg against downward pressure applied below the knee by the examiner. The hip must not be flexed or extended to ensure that only the abductor muscles are used. Gravity and the mechanical advantage supplied by pressing down on the leg ensure that normal muscle can be overcome and even minor weakness will be apparent.

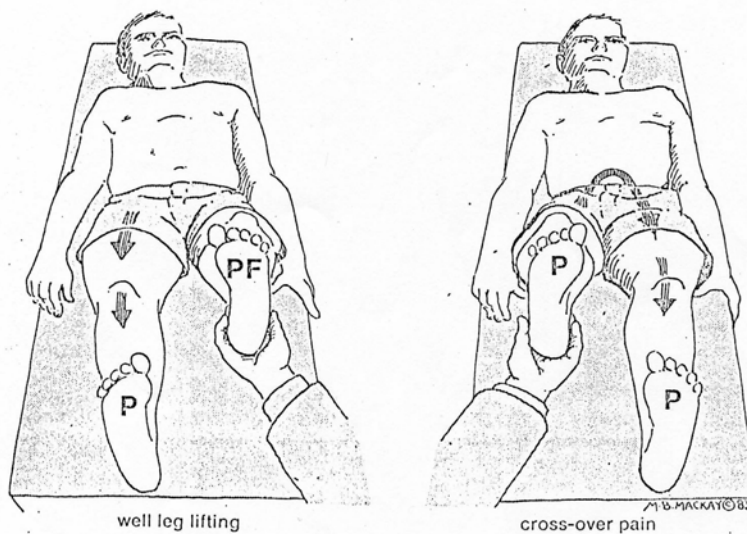


Figure 4. The appearance of “cross-over” pain comes as a surprise to the asymptomatic limb. It is this unexpected finding that signals a central disc rupture.

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The appearance of “cross-over” pain comes as a surprise to the asymptomatic limb. It is this unexpected finding that signals a central disc rupture. P = pain; PF = pain-free

### Position 9: lying prone

The femoral stretch test assesses irritation in the roots of the femoral nerve, L2, L3, and L4. With the patient prone and the knee straight, lift the leg backward to extend the hip and tense the femoral nerve across the front of the pelvis. Pain radiating into the anterior thigh indicates nerve involvement. This manoeuvre also arches the back and often produces the same posterior element back pain the patient experiences on extending the spine while standing. Failure to recognize the true location and significance of the pain can lead to an incorrect diagnosis (18).

Assessing the muscle power of the gluteus maximus and sensation in the midline over the coccyx (the “saddle area”) between the upper buttocks tests nerve conduction. The gluteus maximus is the major extensor of the hip and is supplied mainly by the first sacral component of the sciatic nerve. Testing the power of the gluteus maximus by having the patient actively extend the hip against resistance from the examiner is awkward and insensitive. Since muscle tone is an equally valid reflection of normal function, the gluteus maximus should be assessed by palpating the buttocks while the patient attempts to squeeze them tightly together. Failure to completely tense one buttock is objective evidence of a neurological defect. Gross laxity is obvious, and with experience the examiner can detect even slight variations in muscle tone. It is difficult to tighten only one buttock voluntarily and because the patient has no insight into what constitutes a positive test, this examination is also an excellent check of the patient’s cooperation.

The hamstring reflex is elicited by striking the biceps or semitendinosus tendons behind the knee. Because the hamstrings are almost equally supplied by L5 and S1, the reflex may be lost with a conductive deficit at either level. The diagnostic value of this test relies on comparison with other physical findings. For example, the loss of the hamstring reflex in the presence of a normal ankle reflex suggests an L5 lesion.

Sensation in the saddle area is subtended by the third, fourth, and fifth sacral nerve roots (19). Because of the serious implications of a sensory loss in this area, every back examination must include pin-prick testing between the upper buttocks. Together with cross-over leg pain and the absence of anal sphincter tone, saddle anaesthesia forms a diagnostic triad indicative of an acute central disc herniation. Although extremely rare, a massive posterior midline lumbar disc protrusion is the only surgical emergency resulting from disc prolapse in the lumbar spine. If operative decompression is delayed sustained pressure on the lower sacral roots can lead to permanent bowel and bladder incontinence.

The final procedure in any examination is a rectal examination. In men, palpate the prostate, a common source of spinal metastases. In both men and women, assess the anal sphincter tone and elicit the anal reflex, a sudden contraction of the sphincter at the first touch of the examining finger. These are both functions of the lower sacral roots. Both tone and reflex may be diminished with age, by multiple pregnancies, or in some types of sexual activity. However, in conjunction with the presence of other components of the triad (cross-over leg pain and saddle anaesthesia), their loss is diagnostic of acute central disc herniation.

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#### **Additional observations**

More than 80% of all lumbar disc herniations occur in the last 2 discs of the spine, between L4 and L5 and between L5 and S1. For this reason, the examination is specifically designed to detect and differentiate

weakness attributed to the L5 or S1 nerve roots. Dorsiflexion of the ankle and hip abduction are predominately fifth lumbar nerve functions. Plantar flexion of the ankle and contraction of the gluteus maximus are largely controlled by the first sacral root. By examining all 4 functions, pathology involving either nerve may be demonstrated and verified. Being almost impossible to simulate, the tests for dorsiflexor weakness and decreased muscle tone in the gluteus maximus have the added benefit of providing objective evidence of the patient’s honesty.

Separating functional from organic findings can be difficult. Clinical judgement improves with practice, but even the experienced examiner bases his or her opinion upon several specific examinations. Acetabular rotation, altered straight leg raising, and voluntary release are 3 examples. Although diffuse numbing of the entire leg can accompany the early stages of an acute lower lumbar disc herniation, the persistence of this nondermatome pattern is typically functional. Patients with nonorganic symptoms commonly report a decreased appreciation of pin-prick extending from the foot to the groin or waist and occasionally to one side of the chest, shoulder, and face. In the absence of a corresponding motor or reflex loss, even such an impressive sensory deficit does not reflect organic pathology.

Observe the patient's casual movements and general appearance. A slow painful gait with heavy reliance upon a cane is more indicative of a psychogenic problem than a mechanical back disorder. Similarly, twitching of the spine aggravated by the simplest of movements, sudden lurches, or a desperate clinging to the office furniture for support are rarely genuine pain responses.

Watching the patient attempt a sit-up on the examining table provides useful information. The lack of adequate muscle power to complete a single sit-up graphically demonstrates the absence of abdominal support often associated with symptomatic segmental instability. Acute discogenic back pain is substantially increased on sitting forward, and patients with a recent disc rupture will be unable to complete this action. These patients usually roll to one side and sit up sideways, often using their arms for support. The ability to sit up without difficulty suggests a pain source outside the disc, although not necessarily outside the spine. Patients suffering pain in the facet joints and posterior elements, as well as individuals with predominately psychogenic problems, may be able to perform this action comfortably.

## **Diagnostic Decisions**

With a complete history and physical examination, the clinician has ample information for a preliminary diagnosis. Begin by considering referred causes such as peripheral vascular insufficiency or the causes of pain confined solely to the central nervous system such as spinal cord tumor. Once these are eliminated as possible causes and the pain source is thought to lie within the musculoskeletal structures of the back, clarification of the diagnosis proceeds in a logical fashion.

Pain on back extension indicates a pain source in the posterior elements. Pain from this location can be referred to the groin or thigh without direct nerve root pressure (20). Facet pain is most often due to secondary osteoarthritis of the small synovial joints resulting from intervertebral disc degeneration. Nucleus pulposus dehydration leads to narrowing of the intervertebral distance, which produces subluxation of the apophyseal joints, in arthritic change. The disc is usually the site of the primary pathology, but it is not always the site of pain (21).

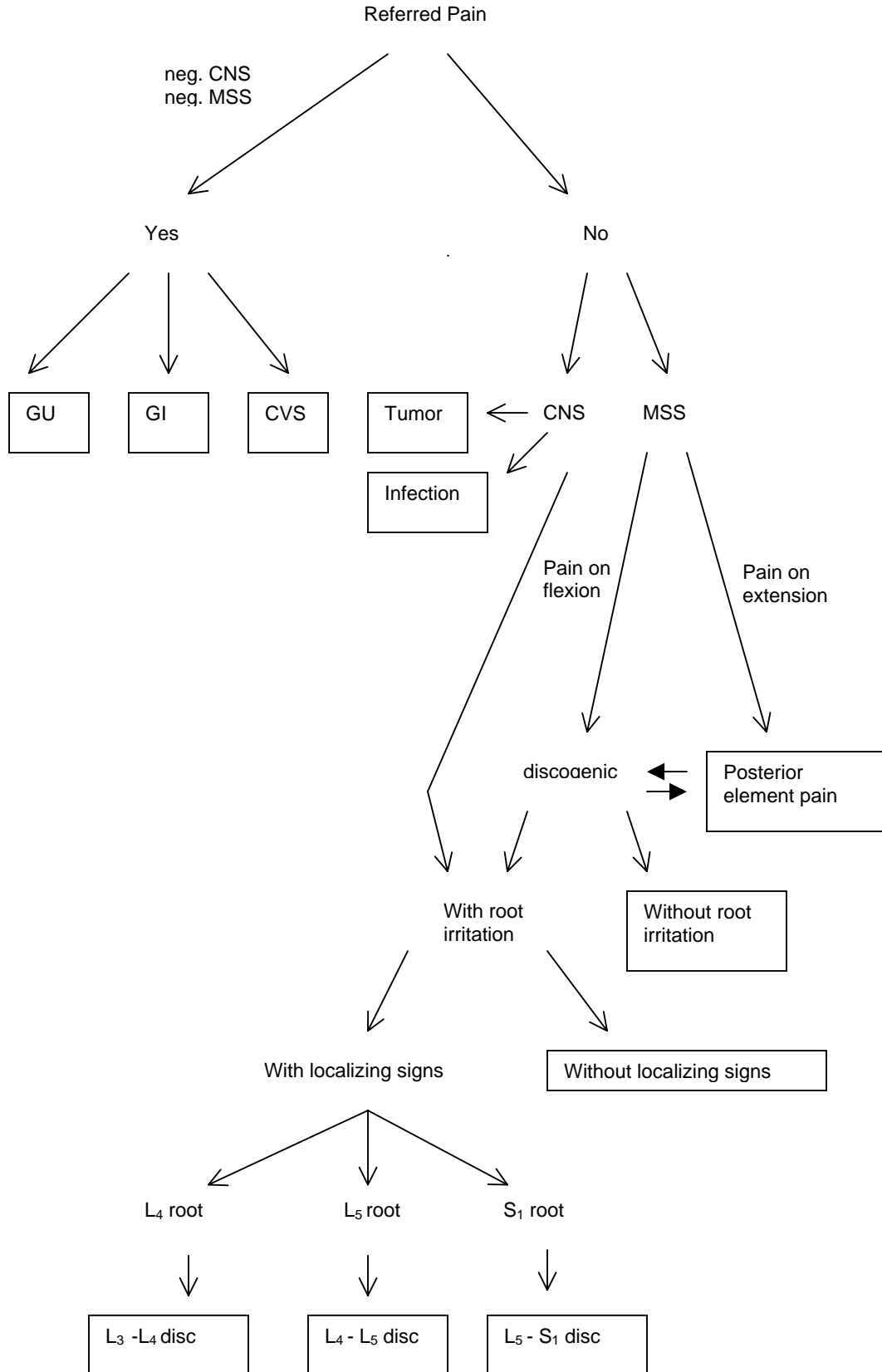
If the diagnosis is discogenic back pain, pain usually increased on forward bending, the physical examination will determine the presence or absence of nerve root irritation. As with symptoms arising in the posterior elements, disc herniation can produce leg pain without direct pressure on a lumbar nerve root.

Contact between a protruding disc and the adjacent nerve does not necessarily imply a conduction deficit. Because the loss of nerve function secondary to disc herniation is easily recognized, it is often the specific diagnosis made. This lesion actually accounts for a very small percentage of the back pain seen in clinical practice, and even in these cases, determining a specific level of involvement is the end of diagnostic sequence, not the beginning (Figure 5).

The examination described here is not intended to include a comprehensive list of every question or physical test used in the assessment of a patient with low back pain. Tests such as jugular venous compression, the maximum range of chest expansion, or the power of ankle eversion may occasionally be useful. This examination provides a framework to be expanded, yet one that is capable of yielding a provision diagnosis in the majority of cases. For patients whose clinical presentations do not conform, consider these seven possibilities.

Figure 5.

The diagnosis of the discogenic back pain with root irritation and localizing signs should be the result of a series of logical observations. Failure to conform to the anticipated progression suggests an alternative diagnosis. CNS = central nervous system; MSS = musculoskeletal system; GU = genitourinary; GI = gastrointestinal; CVS = cardio vascular system



### **1. Is the physical examination accurate?**

Repeat power and reflex testing and ensure that limited straight leg raising or a positive femoral stretch test represent nerve root irritation and not exacerbation of the posterior element or discogenic back pain.

### **2. Is there malignancy?**

The most ominous cause of atypical back pain with multiple level involvement is neoplastic disease of the spine. Further investigation must rule out the possibility of malignancy, particularly in the older patient who fails to respond to adequate therapy.

### **3. Is there a bony entrapment syndrome?**

Spinal canal stenosis produces vascular compromise in the cauda equina or nerve roots and may present a picture easily confused with peripheral vascular claudication. The problem is more common in older patients whose principal symptoms may simply be a feeling of heaviness in the lower limbs associated with chronic low back discomfort and leg pain after walking which is relieved by rest. Objective findings of impaired conduction may exist only after periods of activity or with provocative testing.

### **4. Does the patient have a systematic disease?**

Probably as the result of local vasculitis, diabetes mellitus can produce single nerve root irritation with the appropriate radicular pain, muscle weakness, and reflex loss. Unless the examiner recognizes the absence as discogenic symptoms, the erroneous diagnosis of disc herniation with nerve root pressure may be made.

### **5. Has there been pre-existing back trouble?**

Localizing signs, particularly absent reflexes, may be the result of a previous episode of nerve root pressure and bear no relation to the current attack. A review of the history should help in distinguishing between pre-existing problems and the current clinical picture.

### **6. Has there been spinal surgery?**

Patients who continue to experience back pain after surgery often present with a confusing array of mechanical and neurological symptoms. The clinical picture may contain elements of the original pathology, iatrogenic complications of the operation, and the devastating psychological response to the failure of what many patients consider the ultimate treatment.

### **7. Is the patient malingering?**

Patients may exaggerate their symptoms to impress the examiner with the severity of their cases or in the hope of secondary gain. A bizarre clinical presentation and gross alteration of the physical findings on repeat testing may represent unconscious emotional magnification or, less commonly, a deliberate attempt to deceive the examiner. The presence of psychogenic magnification, however, never precludes the existence of organic involvement (22).

The diagnosis of low back pain should not be synonymous with disc rupture producing neurologic deficit or, lacking objective findings, with chronic anxiety or malingering. Nor should it conjure up a catalogue of exotic diseases. Facet pain, discogenic back pain without nerve root irritation, and discogenic back pain with nerve root irritation but without localizing signs are common and valid diagnoses.

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