Most patients complaining of low back pain experience symptoms from a minor mechanical malfunction. Fewer than 5% have a more sinister explanation such as inflammatory disease, infection, or malignancy.1,2 Faced with a patient in acute distress and grounded in a medical paradigm that emphasizes the serious but uncommon causes of back pain, most physicians hesitate to offer reassurance. Given the relative rarity of back pain resulting from a systemic illness or grave local pathology, investigating all patients with back pain for a

Abstract

In 1987, the Quebec Taskforce noted, “Distinct patterns of reliable clinical findings are the only logical basis for back pain categorization and subsequent treatment.” Identifying these patterns begins with the patient’s history: “Where is your pain the worst?” “Is your pain constant or intermittent?” “Has there been any change in your bowel or bladder function?” This questioning establishes the mechanical nature of the pain, and a physical examination verifies or refutes the pattern established in the history. The examination involves two essential tests to detect upper motor and low sacral root involvement. A failure of the results to fit into one of four syndromes—two back dominant and two leg dominant—suggests a non-mechanical or more complex problem.

Key words: patterns of back pain, pain location, pain characteristics, history, physical examination

Making Sense of Low Back Pain

About the Authors
range of inflammatory back diseases (spondyloarthropathies), for example, will generate unnecessary concern, add unjustified expense, and give minimal return for the effort. Yet these potentially significant diagnoses must not be missed; no one wants to be guilty of overlooking a spinal metastasis.3,4

There is another way. In 1987, the Quebec Taskforce noted, “Distinct patterns of reliable clinical findings are the only logical basis for back pain categorization and subsequent treatment.”5 The use of syndromes in the initial assessment of back pain is gaining renewed interest and clinical acceptance. It avoids many of the pitfalls of the conventional medical model, which requires obtaining a patho-anatomical diagnosis before proceeding with management.6 The use of syndromes allows the great majority of patients with back pain to be sorted into four clearly defined groups that have recognizable mechanical characteristics, and it sets apart the much smaller number who present with atypical, possibly ominous symptoms.

A syndrome can be defined as a constellation of signs and symptoms that appear together in a consistent manner and respond in a predictable fashion. With low back pain, the key is to identify the correct pattern.6 This identification depends on a precise history and a concordant physical examination. The third component of the process is the anticipated positive response. A mechanical syndrome will respond to the appropriate mechanical therapy within weeks, often within days. The failure to distinguish a clear pattern or failure of a syndrome to improve with the specified therapy demands reassessment, including a review of the symptoms, additional physical tests, and, perhaps, ancillary investigations.3,4,7–11

In the example of spondyloarthropathy, the patient who lacks a clear-cut mechanical presentation or who continues to experience significant symptoms after four weeks of suitable care demands particular observation.3,4,7–11 The filtering out of those patients with low back pain who have been accurately identified and successfully managed (over 90% of the total) greatly increases the probability of discovering potentially menacing non-mechanical diagnoses among the remainder. Syndrome recognition is a rapid, reliable, and efficient triage technique that increases diagnostic accuracy, enables patient-specific management, and decreases needless investigations.

The History
Identifying the pattern begins with a concise history, which starts with two questions: “Where is your pain the worst?” and “Is your pain constant or intermittent?” Two of the syndromes are back dominant, with the pain felt most intensely in the low back, in the buttocks, or over the outer aspects of the hips. The other two syndromes exhibit leg dominant pain, where the symptoms are worst around and below the inferior gluteal fold: in the thigh, calf, or foot. Patients frequently have pain in both the back and leg; but with careful questioning, it is possible to determine which site
predominates. This can be challenging, but distinguishing the site of dominant pain is essential for pattern recognition. Axial (back dominant) pain arises from a spinal structure but may have accompanying referred pain into the leg. When forced to choose, patients with axial pain will acknowledge that the back pain is worse. Radicular (leg dominant) pain indicates direct nerve root involvement in addition to the mechanical malfunction. Again, patients often report pain in the back as well as in the leg; but for those with radicular pain, leg pain below the buttock will be the chief complaint.

Determining if the pain is constant or intermittent can be equally or more difficult. Most patients who endure prolonged discomfort describe their symptoms as constant. The inquiry, therefore, must be clear and specific. It is best asked in two parts: “Is there ever a time in the day when your pain stops, for a brief moment, even though it quickly returns?” and “When your pain stops, does it disappear completely? Are you then totally free of pain?” Truly intermittent back dominant pain is never the result of spinal malignancy or an infection. The power of these questions, properly asked and answered, is enormous. They can eliminate the chance of the clinician missing a sinister pathology, one of the commonest concerns about relying so heavily on the history and physical examination.

The third mandatory question is, “Since the start of your back trouble, has there been any change in your bowel or bladder function?” Rather than initially searching for a detailed description, the query is deliberately vague in nature. Specifying changes only since the start of the attack avoids unnecessary worry about previous, unrelated disorders. A report of “no change” removes the necessity to go further. Any positive response requires a more thorough investigation. Urinary retention followed by insensible, uncontrolled overflow and fecal incontinence is indicative of an acute cauda equina syndrome: a surgical emergency.3,12

Five remaining questions complete the clinical picture and establish a link to the past history and the level of present disability:

1. “What are the aggravating movements or positions?”
2. “What are the relieving movements or positions?”
3. “Have you had this same pain before?”
4. “What treatment have you had in the past, and did it work?”
5. “What can’t you do now that you could do before you had the pain?”

Mechanical back pain is responsive to movement and position. Discovering the aggravating and relieving factors helps identify the syndrome and suggests a pain control strategy. Back
pain is a recurrent complaint that tends to worsen with time. In a survey of patients seeking care, over half had suffered more than 10 attacks and over 60% believed that their present attack was, in at least one respect, worse than the preceding one. The degree of physical limitation and the value of past therapies influence the current choices.

**The Physical Examination**

The history defines the syndrome. But the history must be supported by a concordant physical examination. The back examination is not an independent event. Its components are chosen in response to the patient’s story, and its goal is to verify or refute the diagnostic assumptions made on the basis of the history.

Your examination begins with observation including their gait, posture and preferred position in the office. The patient’s general behaviour and level of activity should correspond to what has already been described. Look at the contour of the spine; note any discoloration or scars. Palpation is not diagnostic. It can locate areas of tenderness unrelated to any local pathology that may mislead the examiner.

Having the patient bend forward and backward to reproduce the typical back pain, described in the history, usually confirms the syndrome. The other spinal movements are assessed as dictated by the patient’s functional requirements. Note whether there is a break in the normal rhythm of movement. Recording the range of movement is of little value in an isolated back examination.

Straight leg raising is a measure of sciatic nerve root irritation (L4, L5, S1, S2). Lift the supine patient’s leg while the patient’s knee is extended. To minimize hamstring tightness and a possible misinterpretation of the results, the contralateral hip and knee should be flexed. If positive, the test aggravates the patient’s typical leg dominant pain. The production of back pain is not relevant and merely reflects the underlying mechanical difficulty. The test results are positive when straight leg raising causes the typical leg pain, no matter the degree of elevation. Obviously, pain when lifting the leg 30 degrees is more clinically significant than pain occurring at 80 degrees, but both constitute a positive result. Although the test should be performed on every patient, it can be positive only in someone with a true history of leg dominant pain.

A significant but fortunately rare finding with straight leg raising is the “crossover” sign. When the affected leg is passively elevated, the patient feels not only the anticipated increase in the typical pain in the elevated leg but also pain radiating into the other leg as well. Lifting one leg produces bilateral symptoms. This crossing over of the pain from one to both sides sug-
Figure 1: Physical Examination to Assess Low Back Pain

1. Observation
- Hip Abduction (Trendelenburg) Test (L5 Nerve Root Conduction)
- Ankle Dorsiflexion Test (L4 and L5 Nerve Root Conduction)

2. Standing
- Extension
- Hip Abduction (Trendelenburg) Test (L5 Nerve Root Conduction)
- Heel Walking Test (L4-L5 Nerve Root Conduction)
- Gait
- Toe Walking Test (S1 Nerve Root Conduction)

3. Sitting
- Ankle Dorsiflexion Test (L4 and L5 Nerve Root Conduction)
- Great Toe Flexion Test (S1 Nerve Root Conduction)
- Great Toe Extension Test (L5 Nerve Root Conduction)

* 5 steps at maximum elevation
Classification of Mechanical Patterns of Low Back Pain

<table>
<thead>
<tr>
<th>Reported Pain Location</th>
<th>Pain Constancy</th>
<th>Pain Improved</th>
<th>Pain Worsened</th>
<th>Neurological Findings</th>
<th>Pain Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Back, buttocks or around hips</td>
<td>Constant or intermittent</td>
<td>One of 2 cohorts will improve on extension</td>
<td>Forward flexion, one of the 2 cohorts’ pain also worsens on extension</td>
<td>Normal</td>
<td>Most likely discogenic</td>
</tr>
<tr>
<td>2 Back dominant</td>
<td>Intermittent</td>
<td>Unaffected or may be improved on flexion</td>
<td>Worsens on extension</td>
<td>Normal</td>
<td>Most likely posterior spinal elements</td>
</tr>
<tr>
<td>3 Leg dominant</td>
<td>Constant</td>
<td>By immobility and recumbent rest</td>
<td>By all back movement, usually more by flexion</td>
<td>Positive irritative test and/or conduction loss</td>
<td>Sciatic (or occasionally femoral) nerve root irritation</td>
</tr>
<tr>
<td>4 Leg dominant</td>
<td>Intermittent</td>
<td>Relieved by rest in flexion (sitting)</td>
<td>Activity in extension (walking)</td>
<td>May have positive conduction test; no irritative test.</td>
<td>Neurogenic claudication, often mislabelled spinal stenosis</td>
</tr>
</tbody>
</table>
gests nerve root irritation from a centrally placed intrusion. A central disc herniation can compress the sacral roots controlling bowel and bladder function and may trigger an acute cauda equina syndrome. The crossover sign should not be confused with the reproduction of typical leg pain on the affected side when lifting the unaffected leg. This manoeuvre, correctly designated “well-leg lifting,” confirms an extremely irritated nerve root but signifies unilateral compression incapable of provoking a cauda equina syndrome.

Femoral stretch is a root irritation test for the femoral nerve (L2, L3, L4). It is carried out with the patient prone and the affected leg extended. Lift the patient’s leg into extension; a positive test result reproduces the typical leg pain, in this case in the anterior distal thigh. The manoeuvre frequently induces back pain, an incidental albeit unpleasant finding. Because the femoral nerve is so infrequently affected, the test can be limited to those patients who present with an account of constant anterior thigh dominant pain.

About 80% of nerve root compromise associated with low back pathology occurs at L5 or S1 (L4 adds approximately another 8%), so it makes sense to screen L5 and S1 functions as part of the examination. Motor testing is preferred. Once lost, reflexes may not return, and slight variations can give an erroneous picture of the current problem. Sensory testing is largely subjective.

For patients with back dominant pain, an adequate motor test of L5 is the power of the long extensor of the big toe. For S1, it is sufficient to test the strength of the great toe’s long flexor. If indicated, for example in leg dominant pain, additional neurological tests include quadriceps power and the knee reflex for L3 and L4; heel walking, ankle dorsiflexion (tested with the patient seated and attempting to elevate the forefoot against resistance) and hip abduction (Trendelenburg test) for L5; toe walking, hip extension (tested by palpating the muscle tone in the gluteus maximus as the patient repeatedly tenses and relaxes the muscle) and the ankle reflex for S1. Both L4 and L5 innervate ankle dorsiflexion but, since L4 is only occasionally involved with low back pain, the test is generally employed for the latter root.

Every low back examination must include an upper motor test and a check of saddle (perineal) sensation. Every low back examination must include an upper motor test and a check of saddle sensation. The upper motor examination, usually the plantar response, is always negative in low back pathology. Any indication of direct spinal cord involvement warrants a more detailed proximal neurological examination. This finding negates a mechanical diagnosis. Saddle sensation is subtended by the same lower sacral nerves that supply the bowel

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**Key Point**

The goal of the physical examination is to verify or refute the diagnostic assumptions made on the basis of the history.
and bladder. An altered response to sensory testing in this area raises the possibility of an acute cauda equina syndrome, which must be carefully pursued including, when indicated, a rectal examination.

**The Four Syndromes**

At the conclusion of the history and physical examination, the overwhelming majority of patients can be classified into one of four mechanical patterns.

In the first and most common syndrome, patients describe pain that is most excruciating in the back, in the buttocks, or around the hips and is increased by bending forward. The pain may be constant or intermittent. The neurological findings will all be normal. Within this group, there are two well-defined cohorts: one gains relief with extension, the other has pain with movement in either direction. The physical examination will support the history, with the patient’s typical back pain aggravated on flexion and either improved or further exacerbated on extension. For some patients, the extension movement must be performed in a non-weight bearing position of prone lying. This is an ideal time to educate these patients on the use of this manoeuvre for pain management.

The goal of syndrome recognition is to dispense with the need to establish a pathological diagnosis before proceeding to primary treatment; but it is impossible not to speculate on the most likely source of the pain. In this case, the picture strongly suggests a discogenic origin. The focus, however, should remain on the clinical presentation and not on the putative pain generator. A degenerative disc seen on magnetic resonance imaging does not necessarily equate with this first syndrome.7,10

The second mechanical pattern is also back dominant but is much less common. Patients report pain on bending backward but have no trouble, and are often more comfortable, bending forward. The pain is intermittent. Again, the physical examination reinforces the history. The patient’s usual back pain is worsened on extension but is either unaffected or improves on flexion. The neurological examination is normal. The source of pain in this syndrome is less clear, possibly the posterior elements of the spine. But
while the location of the pain generator is uncertain, the pattern of the pain is obvious.

The next two syndromes involve leg pain dominant, and both correspond to well-established diagnoses. Here the challenge is the contamination of the terminology, with the resultant blurring of the clinical picture.

The third syndrome is one of constant leg dominant pain with associated positive neurological findings, indicated by either irritative tests such as the straight leg raise or a loss of motor, reflex, or sensory function. This is the exact description of sciatica: constant leg dominant pain with a necessarily positive neurological examination. This most accurately equates to radiculitis, inflammation of a spinal nerve root. But sciatica has come to mean simply leg pain. Patients and too many health care providers are convinced that any time the pain spreads to the leg, there must be a pinched nerve. As a result, many patients with referred leg pain from a back dominant pattern are given the wrong diagnosis.

The final syndrome also has leg dominant pain. Here the pain is intermittent, comes on with activity in extension (walking), and is relieved by rest in flexion (sitting). Since the patient is not active during the assessment, the physical examination is usually normal. The correct diagnosis for this pattern is neurogenic claudication, but in clinical practice, it is often mislabelled spinal stenosis. Spinal canal narrowing is a structural abnormality that may induce neurogenic claudication but that may be asymptomatic. Spinal stenosis is not a diagnosis, and its presence on an image does not predict the patient’s symptoms. Syndrome recognition, which emphasizes the clinical presentation, is the proper approach.

Conclusion

Low back pain is not an impenetrable morass. Recognizing a syndrome within a myriad of other complaints requires a meticulous history, a precise supporting physical examination, and practice, but it enables immediate mechanically based treatment without misleading and unnecessary spinal imaging. Managing low back pain is not a one-time event. Low back pain is a chronic condition that demands ongoing care and follow-up. When the clinician can reliably separate nine of 10 patients into one of the four groups, each with its own distinct characteristics and appropriate treatment, and when the outliers can be quickly and clearly identified, low back pain begins to make sense.

References

### Clinical Pearls

<table>
<thead>
<tr>
<th>Questions:</th>
<th>Interpretation:</th>
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| “Where is your pain worst?”                                               | Back Dominant Pattern I or II  
Leg Dominant Pattern III or IV                                                   |
| “Is your pain intermittent or constant?”                                  | Intermittent is a mechanical syndrome  
Constant LBP – rule out Red Flags  
• Neurological  
• Infection  
• Fracture  
• Tumour  
• Inflammation  
• Possible Pain Disorder (Yellow flags) |
| “Has there been any change in your bowel or bladder function since the onset of your back pain?” | If yes, inquire about further neurological symptoms to rule out Cauda Equina (Surgical Emergency). |
| “What are the aggravating movements or positions?”                        | Pattern 1  
a) Flexion  
Aggravated  
B) Flexion/Extension  
Aggravated  
Pattern 2  
Extension  
Aggravated  
Pattern 3  
Flexion  
Aggravated  
Pattern 4  
Extension  
Aggravated |
| “What are the relieving movements or positions?”                          | Management Strategies:                                                        |
| “Have you had this same pain before?”                                     | Reinforce the key messages that recurrence is typical and is not linked to worsening pathology |
| “What treatment have you had in the past and did it work?”                | Dispel myths of passive treatment. Identify active approaches related to the mechanical patterns |
| “What can’t you do now that you could do before you had the pain?”         | Begin self-management strategies focused on the patients needs.                 |
Physical Examination
To minimize patient discomfort and maximize efficiency, progress from tests done standing to those in sitting and finally to lying down. The minimum assessment is marked**

Gait
• Heel walking (L4-5)
• Toe walking (S1)

Standing Position
• **Movement testing—flexion and extension
• Trendelenburg test (L5)
• Repeated toe raises (S1)

Sitting Position
• **Patellar reflex (L3-4)
• Quadriceps power (L3-4)
• Ankle dorsiflexion power (L4-5)
• **Great toe extension power (L5)
• **Great toe flexion power (S1)
• **Plantar response, upper motor test

Kneeling Position
• Ankle reflex (S1)

Supine Lying Position
• **Passive straight leg raise

Prone Lying Position
• Femoral nerve stretch (L3-4)
• Gluteus maximus power (S1)
• **Saddle sensation testing (S2-3-4)
• Passive back extension (patient uses arms to elevate upper body)


