



Safety-Gated Patient Selection for Lumbar Decompression: A Clinical–Imaging Concordance Framework for Nerve Root Compression and Radiculopathy

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Abstract- Selecting the right patient is the most important determinant of benefit from lumbar decompression, yet degenerative findings on magnetic resonance imaging (MRI) are common in people without symptoms. In published pooled estimates, disc bulges are present in 30% of asymptomatic people at age 20 and 84% at age 80, and disc protrusions in 29% and 43%. Imaging alone therefore cannot establish that a compressed nerve root is the source of a patient’s symptoms. This paper presents a patient-selection framework for nerve root compression and radiculopathy that combines a red-flag safety gate with structured clinical localisation and a clinical–imaging concordance score. The score rates four elements—level, side, symptom pattern and neurological signs—from 0 to 2 each, giving a total of 0–8 that is graded as high (7–8), partial (4–6) or low (0–3) concordance, and each grade is linked to a defined action. A root-level localisation table supports consistent clinical examination. The framework is a proposed design derived from a doctoral thesis; it reports no patient data, and its reliability and predictive value remain to be tested.

Keywords- Lumbar radiculopathy, nerve root compression, patient selection, clinical–imaging concordance, red flags, MRI, spinal decompression

I. Introduction

Lumbar nerve root compression from disc herniation, lateral recess or foraminal stenosis, or degenerative spondylolisthesis causes radicular leg pain, sensory change, weakness and, in central stenosis, neurogenic claudication. Decompression can provide greater or faster relief than continued non-operative care in carefully selected patients [1], [2], and guidelines recommend it for patients with moderate to severe symptoms that persist despite conservative treatment [3]. The phrase “carefully selected” carries much of the weight: when the compressed root is not the cause of the symptoms, surgery exposes the patient to risk without prospect of benefit.

Degenerative changes on MRI are common in people without back pain [4], so the radiological finding must be matched to the clinical picture. In routine practice, this matching is usually informal. This paper contributes: (1) a five-step selection pathway beginning with a red-flag safety gate; (2) a root-level localisation table for clinical

examination; and (3) a four-element clinical–imaging concordance score with defined actions for each grade.

Background

Imaging Findings in Asymptomatic People

In an early MRI study of people without back pain, about two-thirds had an abnormality of at least one lumbar disc, most commonly a bulge or protrusion [4]. A later systematic review pooled data from 33 studies and estimated age-specific prevalence of degenerative findings in asymptomatic populations [5]. Fig. 1 plots these estimates: disc degeneration rises from 37% at age 20 to 96% at 80, disc bulge from 30% to 84%, facet degeneration from 4% to 83% and spondylolisthesis from 3% to 50%. Because the patients considered for decompression are mostly middle-aged or older, a finding on imaging is likely to be present whether or not it explains the symptoms.

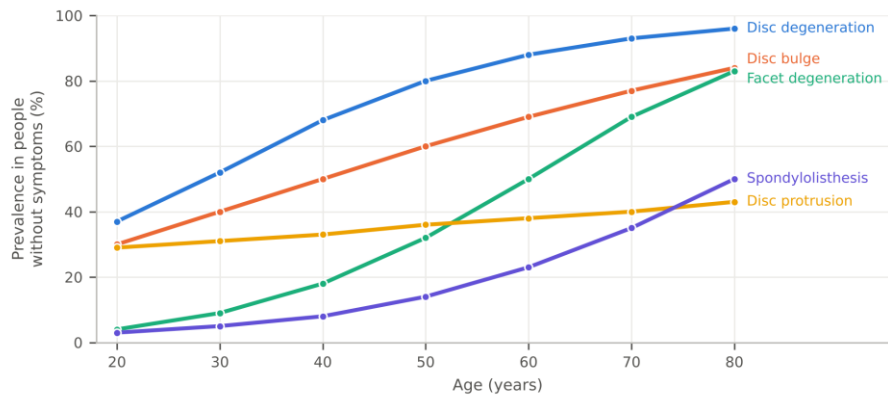


Fig. 1. Age-specific prevalence of degenerative lumbar imaging findings in people without symptoms, from the pooled estimates of Brinjikji *et al.* [5]. Values are model-based estimates reproduced from the published table.

Implications for Patient Selection

Clinical reviews therefore stress that decompression should be offered only when symptoms, signs and imaging agree [6]. The same principle applies to the extent of surgery: in trials, adding fusion to decompression did not improve outcomes in most patients with stenosis [7] and offered modest benefit only in selected stable spondylolisthesis [8], so the imaging assessment must also identify instability rather than assume it.

II. Proposed Selection Framework

1. Selection Pathway

Fig. 2 shows the pathway. After referral, the red-flag gate identifies presentations that require urgent rather than elective management: cauda equina syndrome (saddle anaesthesia, new bladder or bowel dysfunction), progressive motor deficit, suspected infection, malignancy or fracture. Table I lists the red-flag categories and the action

required for each. Patients with red flags leave the elective pathway immediately, and the gate is re-applied whenever symptoms change. For the remainder, clinical localisation is completed before imaging is reviewed, so that the examination is not biased by the scan. Imaging is then interpreted, the concordance score is calculated and an action is assigned.

Table I Red-Flag Gate: Findings and Required Actions

Category	Example findings	Action
Cauda equina syndrome	Saddle anaesthesia, new bladder or bowel dysfunction, bilateral leg symptoms	Emergency MRI and surgical review
Progressive deficit	Worsening weakness, e.g. new foot drop	Urgent imaging and surgical review
Infection	Fever, immunosuppression, recent spinal procedure	Urgent investigation
Malignancy	Previous cancer, weight loss, night pain	Urgent investigation
Fracture	Significant trauma, osteoporosis, long-term steroids	Imaging; fracture pathway

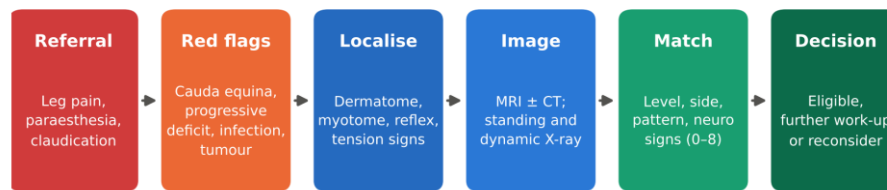


Fig. 2. Safety-gated patient-selection pathway. The red-flag gate precedes all elective steps, and clinical localisation is recorded before imaging is reviewed.

2. Clinical Localisation

Table II summarises the clinical features used to localise the affected root. A posterolateral disc herniation usually compresses the traversing root (for example, the L5 root at L4–L5), whereas a foraminal or far-lateral herniation compresses the exiting root (the L4 root at L4–L5). Recording the expected root and level before imaging allows the concordance check in the next step to be made objectively.

Table 2: Clinical Localisation of Lumbar Nerve Roots

Root	Sensory distribution	Motor	Reflex	Tension sign
L3	Anterior thigh to medial knee	Knee extension, hip adduction	Patellar (may be reduced)	Femoral stretch
L4	Medial leg to medial malleolus	Ankle dorsiflexion, knee extension	Patellar	Femoral stretch



Root	Sensory distribution	Motor	Reflex	Tension sign
L5	Lateral leg, dorsum of foot, great toe	Great toe extension, hip abduction	No reliable reflex	Straight-leg raise
S1	Lateral foot, sole, little toe	Plantar flexion, foot eversion	Achilles	Straight-leg raise

3. Concordance Score

The concordance score rates four elements from 0 to 2 (Table III). The total ranges from 0 to 8. Scores of 7–8 indicate high concordance, and the patient may proceed to shared decision-making once conservative care has been adequate. Scores of 4–6 indicate partial concordance, which calls for further work-up—for example, selective nerve root block, neurophysiology or multidisciplinary review. Scores of 0–3 indicate low concordance, in which the diagnosis is reconsidered and decompression is not offered on the basis of imaging alone.

Table 3: Clinical–Imaging Concordance Score

Element	2 points	1 point	0 points
Level	Compression at the level predicted clinically	Adjacent or multiple levels	No compression at a plausible level
Side	Same side as symptoms	Central or bilateral compression	Opposite side
Symptom pattern	Dermatomal leg pain or typical claudication	Non-specific leg pain	Axial pain only
Neurological signs	Deficit matching the compressed root	Tension sign only	No signs, or signs of another root

Dynamic radiographs are reviewed at the same stage. Documented instability is recorded separately, because it changes the surgical plan rather than the indication, and fusion is considered only when instability is present [7], [8].

4. Imaging Standards

MRI is the primary investigation because it shows the disc, ligamentum flavum, facet joints and nerve roots without radiation. Axial and sagittal sequences are reviewed at every level, and the report records the level, side and zone of compression (central, lateral recess, foraminal or extraforaminal), so that each element of the concordance score can be assigned. Computed tomography is added when bony anatomy matters, for example in foraminal stenosis or when MRI is contraindicated. Standing radiographs show alignment, and flexion–extension views are obtained when spondylolisthesis is present or suspected.

5. Adequacy of Conservative Care

High concordance identifies the source of symptoms but does not by itself indicate surgery. Many patients with sciatica improve without operation, and outcomes after one year can be similar with early surgery or prolonged conservative care [2]. The framework therefore requires a documented trial of structured conservative care—education, analgesia, graded activity and physiotherapy, with epidural injection where



appropriate—with review at 6–12 weeks, unless the red-flag gate or disabling deficit indicates earlier surgery. Patients who meet both requirements, high concordance and adequate conservative care, proceed to a shared decision about decompression.

III. Discussion

The framework turns a common clinical judgement into explicit, recordable steps. Its main safeguard is ordering: red flags first, clinical localisation before imaging, and concordance before any surgical discussion. Given the high prevalence of asymptomatic findings (Fig. 1), this ordering reduces the risk that an incidental finding drives the decision. The score also makes disagreements visible: two clinicians who reach different grades can identify which element they scored differently.

The framework has limitations. The point values and grade boundaries are proposed, not derived from outcome data; their inter-rater reliability and their ability to predict benefit from surgery have not been tested. Clinical signs have imperfect sensitivity, and some patients with genuine radiculopathy will have no deficit. The partial-concordance grade is intended for these cases, so that they are investigated further rather than excluded.

Implementation needs little equipment: a structured examination form based on Table II, a concordance worksheet based on Table III and a field in the record for the red-flag check. Recording the score for every patient also creates audit data, allowing a service to examine how often surgery is offered at each concordance grade and whether outcomes differ between grades.

IV. Conclusion

Because degenerative imaging findings are common in people without symptoms, selection for lumbar decompression must rest on agreement between clinical presentation and imaging. This paper proposed a safety-gated pathway, a root-level localisation table and a four-element concordance score with defined actions. Future work will test the inter-rater reliability of the score with clinical vignettes and evaluate in a prospective cohort whether higher concordance predicts greater improvement after decompression.

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