The terminology for disc abnormalities is very **CONFUSING** and **INCONSISTENT** in the literature.

To address the remaining needs and in hopes of securing endorsement sufficient to result in universal standardization, joint task forces were formed by the **North American Spine Society (NASS)**, the **American Society of Neuroradiology (ASNR)**, and the **American Society of Spine Radiology (ASSR)**. The following reference is the product of those task forces:

**Nomenclature and Classification of Lumbar Disc Pathology.**
David F. Fardon, MD and Pierre C. Milette, MD†
SPINE Volume 26, Number 5, pp E93–E113

This **STANDARIZED NOMENCLATURE** describes discs and leaves to the **clinician** the description of the patient.

For classification purposes, the intervertebral disc is considered as a two-dimensional round or oval structure having four 90° quadrants.
“HERNIATION”: localized displacement of disc material beyond the limits of the intervertebral disc space.

- Displacement can only occur in association with disruption of the normal annulus or, as in the case of intravertebral herniation, a break in the vertebral body endplate.

“Herniated nucleus pulposus” is inaccurate because disc materials other than nucleus (cartilage, fragmented apophyseal bone, fragmented anulus) are common components of displaced disc material.

The term "localized" contrasts to “generalized,” the latter being arbitrarily defined as greater than 50% (180 degrees) of the periphery of the disc.

The 50% cut-off line is established by way of convention to lend precision to terminology and does not demarcate etiology, relation to symptoms, or treatment indications.

HERNIATION

Localized displacement of disc material beyond the limits of the intervertebral disc space.

- About 90% of lumbar disc herniations occur at L5 – L4 or L5 – S1.
- Over 90% of lumbar disc herniations affect the central and paracentral zones.
LOCALIZED displacement (herniation) in the axial (horizontal) plane can be:

“FOCAL”: less than 25% of the disc circumference

“BROAD-BASED”: between 25 and 50% of the disc circumference

Focal L5 – S1 central and left central herniation. The left S1 nerve root (white arrow) is displaced by the disc herniation.

“BULGING”: generalized displacement of disc material (50 – 100%) or presence of disc tissue “circumferentially” beyond the edges of the ring apophyses
"Bulging", by definition, is NOT considered a form of herniation.

Bulging is sometimes a normal variant (usually at L5-S1); can result from advanced disc degeneration or from vertebral body remodeling (as consequent to osteoporosis, trauma, or adjacent structural deformity); can occur with ligamentous laxity in response to loading or angular motion; can be an illusion caused by posterior central subligamentous disc protrusion; or can be an illusion from volume averaging (particularly with CT axial images).

Application of the term “bulging” to a disc does not imply any knowledge of etiology, prognosis, or need for treatment or necessarily imply the presence of symptoms.

The size of the vertebral body must be compared to the size of the adjacent disc.
**BULGING**

*Generalized* displacement of disc material beyond the limits of the intervertebral disc space.

L3 – L4 disc **bulging**. Note the loss of the high signal nucleus pulposus (star) from advanced disc degeneration*

* With loss of disc height the peripheral annulus fibrosus becomes redundant and bulges outward.

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**Herniated discs may take the form of PROTRUSION or EXTRUSION, based on the shape of the displaced material:**

**These terms ("protrusion" and "extrusion") do NOT imply knowledge of the mechanism by which the changes occurred and thereby DIFFER from definitions that base the distinction on whether and how disc material has passed through a defect in the annulus.**

**“PROTRUSION”:** the greatest distance, in any plane, between the edges of the disc material beyond the disc space is **less** than the distance between the edges of the base*, in the same plane.

* The **base** is defined as the cross-sectional area of disc material at the outer margin of the disc space of origin, where disc material displaced beyond the disc space is continuous with disc material within the disc space.
In the cranio-caudal direction, the length of the base CANNOT exceed, by definition, the height of the intervertebral space.

Though “protrusion” has been used by some authors in a nonspecific general sense to signify any displacement, the term has a more commonly used specific meaning for which it is best reserved.
“EXTRUSION” is present when:

- In at least one plane, any distance between the edges of the disc material beyond the disc space is greater than the distance between the edges of the base.

L4 – L5 left central disc extrusion (star): the edges of the disc material beyond the disc space in the anteroposterior axis is greater than the distance between the edges of the base in the sagittal plane. The left L5 nerve root is markedly displaced (yellow arrow). Note the right L5 nerve root in the righ subparticular zone (dashed arrow).
When no continuity exists between the disc material beyond the disc space and that within the disc space.

L2 – L3 disc extrusion: the edges of the disc material beyond the disc space in the longitudinal axis is greater than the distance between the edges of the base in the sagittal plane.
EXTRUSION

There is disc material beyond the disc space, posterior to the L4 vertebral body (pink arrows), without connection with the L4 – L5 disc (note the gap within both structures: dashed black arrow). This is, by definition, a sequestered disc extrusion.

EXTRUSION may be further specified as:

**SEQUESTRATION:** if the extruded disc material has lost completely any continuity with the parent disc.

**MIGRATION:** displacement of disc material away from the site of extrusion, regardless of whether sequestrated or not.

A sequestrated disc is a subtype of “extruded disc” and, by definition, can NEVER be a “protruded disc.”
Disc extrusion with **MIGRATION**

L4 – L5 disc **extrusion** (star) with **migration** below parent disc, maintaining continuity with it. Note on the axial image that the thecal sac is markedly compressed and distorted, with loss of its normal round shape. Note on the sagittal image that there is also advanced L4 – L5 disc degeneration with diffuse low signal intensity throughout the disc and loss of disc height.

**Posterior annular tear** *(dashed arrow)* with a central focal disc **extrusion** *(pink arrows)* with **migration** below parent disc, maintaining continuity with it.
Because posteriorly displaced disc material is often constrained by the posterior longitudinal ligament, images may portray a disc displacement as a protrusion on axial section and an extrusion on sagittal sections, in which cases the displacement should be considered an extrusion!

Extrusion that mimics a protrusion on axial section because the displaced disc material is constrained by the posterior longitudinal ligament.

“INTRAVERTEBRAL HERNIATIONS” (Schmorl’s node): Herniated discs in the cranio-caudal (vertical) direction through a break in the vertebral body endplate.
Further characterization

Referring to the posterior longitudinal ligament (PLL), some authors have distinguished displaced disc material as:

**SUBLIGAMENTOUS:**
- Beneath the PLL

**EXTRALIGAMENTOUS:**
- Posterior or lateral to the PLL

**TRANSLIGAMENTOUS** or **perforated:**
- Displacement, usually extrusion, of disc material through the PLL

The distinction between outer annulus and posterior longitudinal ligament may not always be identifiable.
When the distinction between the outer anulus and the PLL is unclear and a fragment is under such a blended structure, “SUBCAPSULAR” is appropriate.

Such permutations of relationships to ligaments are refinements that may suit certain purposes but do NOT supersede the basic definition of disc herniation and the major subcategorizations of EXTRUSION and PROTRUSION.

Volume of Displaced Material

A simple scheme to define the degree of canal compromise produced by disc displacement utilizes measurements taken from an axial section at the site of the most severe compromise:

1) Mild: Canal compromise of less than one third of the canal at that section
2) Moderate: between one and two thirds
3) Severe: over two thirds

The same grading can be applied for foraminal involvement.

Location of disc abnormalities

Moving from central to right lateral in the axial (horizontal) plane, location may be defined as central (zone within the vertebral canal between sagittal planes through the medial edges of each facet) → right central → right subarticular → right foraminal → right extraforaminal.

For reporting of image observations of a specific disc, right central or left central should supersede use of the term paracentral *

* When the side is unspecified, or grouped with both right and left represented, the term paracentral is appropriate.
OTHER ABNORMALITIES

Instances in which data suggest abnormal morphology of the disc but are not complete enough to warrant a diagnostic categorization can be categorized as **MORPHOLOGIC VARIANT OF UNKNOWN SIGNIFICANCE**.

REPORTING

Reports should classify each disc examined into broad diagnostic categories*.

*Further specificity may be appropriate depending on the data and the purpose of the examination.

The ability to distinguish between various forms of herniation and between broad-based protrusion and bulging depends on the adequacy of available imaging data and the judgment of the interpreter.

Interpretations are made with various degrees of confidence. Statement of the degree of confidence is an important component of communication. The reporter should characterize the interpretation as:

a) DEFINITE: there is no doubt.
b) PROBABLE: there is some doubt but the likelihood is greater than 50%,
c) POSSIBLE: there is reason to consider but the likelihood is less than 50%.

The term "herniated disc" does NOT imply any knowledge of etiology, relation to symptoms, prognosis, or need for treatment. Clinical significance related to the abnormalities in disc morphology depends on **CORRELATION WITH CLINICAL DATA** and **cannot** be inferred from morphologic data alone.

If the interpreter has information enough to do so, he or she MAY FURTHER SUGGEST that the imaging findings are, or are not, related to the patient’s symptoms, but the descriptive terms and diagnostic categories proposed are NOT meant to infer any relationship to symptoms or need for treatment. **Suggestions for additional studies** to improve the level of confidence are often appropriate.
“39 year old woman with left sciatica”

L5–S1 disc degeneration with diffuse low signal intensity throughout the disc on T2W images. There is a focal central and left central disc herniation. The left S1 nerve root (dashed arrow) is mildly displaced by the disc herniation. There is also mild acquired central canal stenosis (the thecal sac is compressed by the central disc herniation, with loss of its normal round shape).

“35 year old woman with left sciatica in the S1 left territory. L5–S1 disc herniation?”

L5–S1 disc degeneration with diffuse low signal intensity throughout the disc on T2W images. There is a focal central and left central disc herniation. The left S1 nerve root (dashed arrows) is displaced and markedly compressed between the disc herniation and the facet joint in the left subarticular zone. There is also moderate acquired central canal stenosis (the thecal sac is compressed by the central disc herniation, with loss of its normal round shape).
Radiculopathy due to disc herniation is the most frequent spinal disorder and can be **clinically diagnosed** in cases with typical presentation.

In less typical cases of in the presence of additional accompanying neurological and medical disorders, **EMG recordings** are the method of choice for objectifying a radiculopathy of the motor nerve fibers*.

* Damage to the nerve roots presents in a radicular distribution of sensory (dermatome) and motor (myotome) deficits. A peripheral nerve lesion, like the compression of the peroneal nerve close to the fibula head, induces pathological findings in NCS (conduction failure with reduced or even abolished CMAP) and pathological EMG findings in the distal muscles innervated by the peroneal nerve; while a complete motor L5 radiculopathy shows no NCS pathology but produces pathological EMG findings (signs of denervation) in the proximal and distal L5 innervated muscles.

**Neurophysiological studies allow radiculopathy to be differentiated from peripheral neuropathy**

- A normal EMG does **not** exclude a nerve compromise (ie, severe pain in a radiculopathy) that has not yet induced motor nerve damage.

![Diagram of spinal column with paracentral herniation and EMG findings](image)

**Typical Electromyographic findings in an L4 – L5 paracentral herniation with muscle denervation**

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<th>EMG</th>
<th>L3-L4-L5-S1</th>
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<td>Spontaneous activity</td>
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