

Review And Update Of Correct Nomenclature For Lumbar Spine Disc Disease

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Learning objectives

To review, unify and propagate disc pathology correct nomenclature and classification in Magnetic Resonance Imaging.

To illustrate on examples different types of disc disease according to current recommendations in order to simplify correct reporting process in clinical practice and ensure accurate communication between Radiologists and their referring clinicians.

Background

MRI is the imaging modality of choice for the investigation of intervertebral disc disease.

Standardized disc pathology nomenclature and classification in Magnetic Resonance Imaging were published in 2001 by the Combined Task Force of the North American Spine Society, American Society of Spine Radiology and the American Society of Neuroradiology and subsequently endorsed by other professional organizations and scientific societies.

Despite multiple articles published in recent years quoting standardised terminology recommendations from 2001 there is still a wide variety of radiological interpretation of what constitutes a particular disc pathology. For example the distinction between a disc protrusion and an asymmetrical disc bulge is often open to individual interpretation. This lack of consistency is also prevalent in the literature with a variety of definitions being used.

We reviewed the database from our institution over the last 5 years and analyzed the number of MRIs performed of the lumbar spine and cross referred to findings of disc disease. In total 5, 860 lumbar spines were performed with reports and images available in 5, 223 cases. Out of these 3, 823 had disc disease. Cases from these cohort were utilized for this educational exhibit.

We also reviewed the literature to assess best current practice in correctly diagnosing disc disease. Illustrative diagrams defining disc pathology as well as representative images have been utilized in this exhibit to clearly define the correct interpretation of disc disease.

Images for this section:

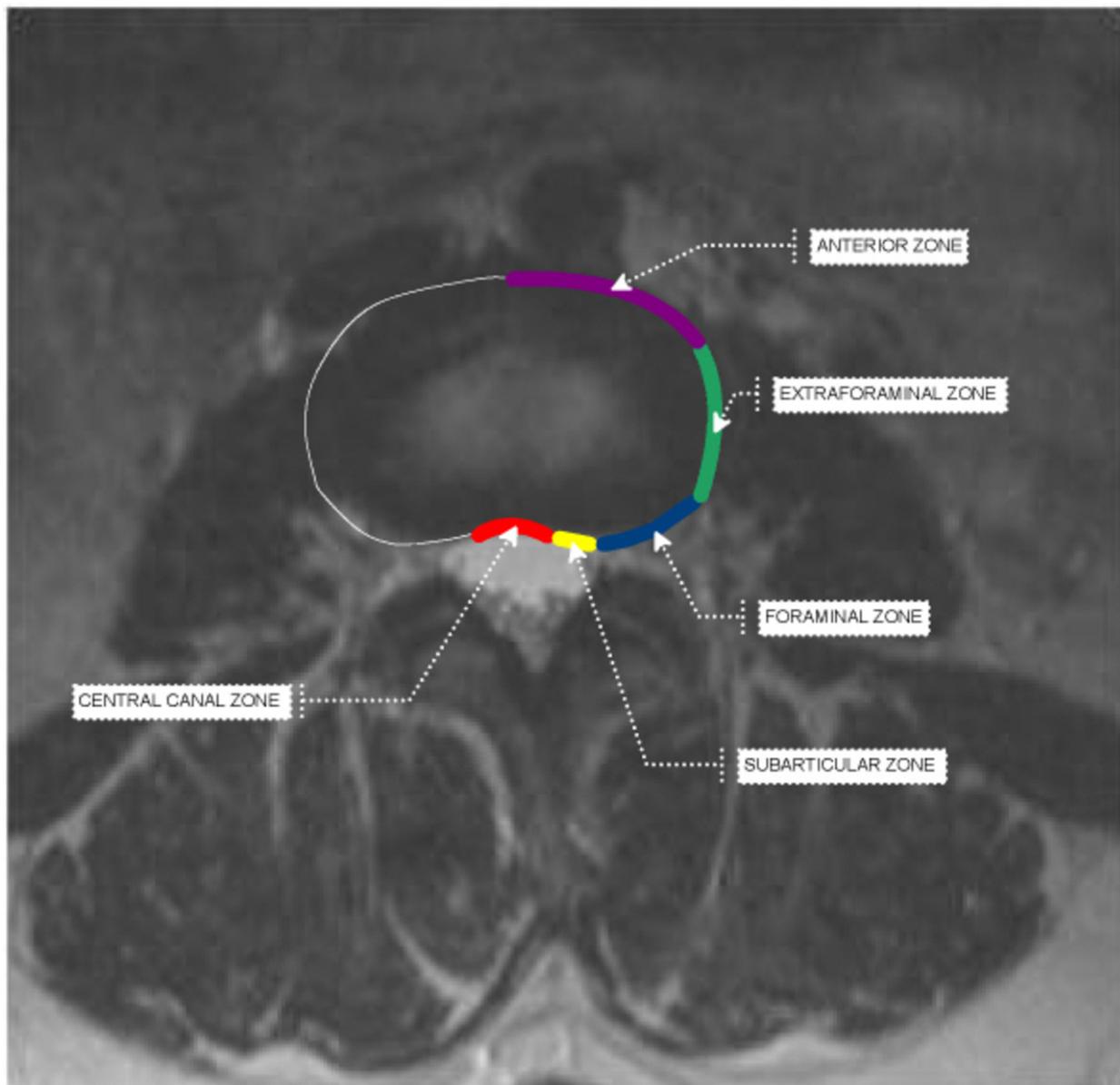


Fig. 12: Schematic representation of the anatomical zones identified on an axial T2 weighted image (red line - central zone yellow line - subarticular zone (lateral recess blue line - foraminal zone (pedicle zone) green line-extra-foraminal zone (far lateral zone))

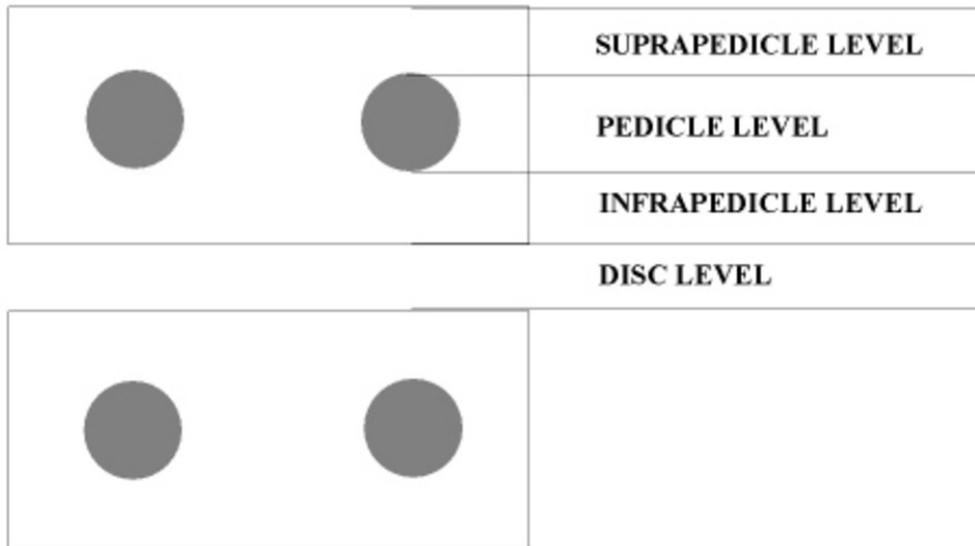


Fig. 20: Schematic Illustration showing representation of the anatomical disc herniation Levels in sagittal plane

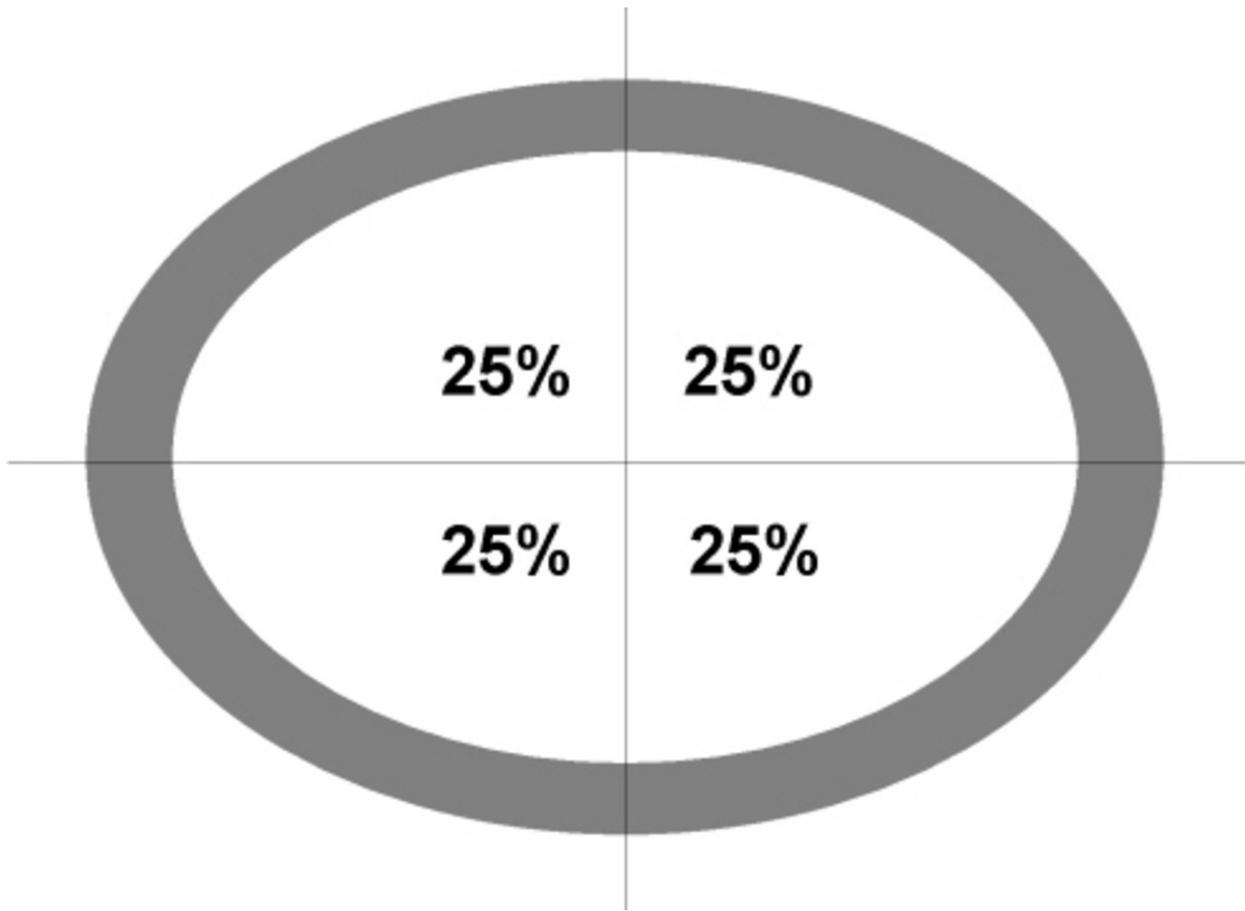


Fig. 8: Schematic Illustration of Symmetrical Disc Bulge in Axial Plane

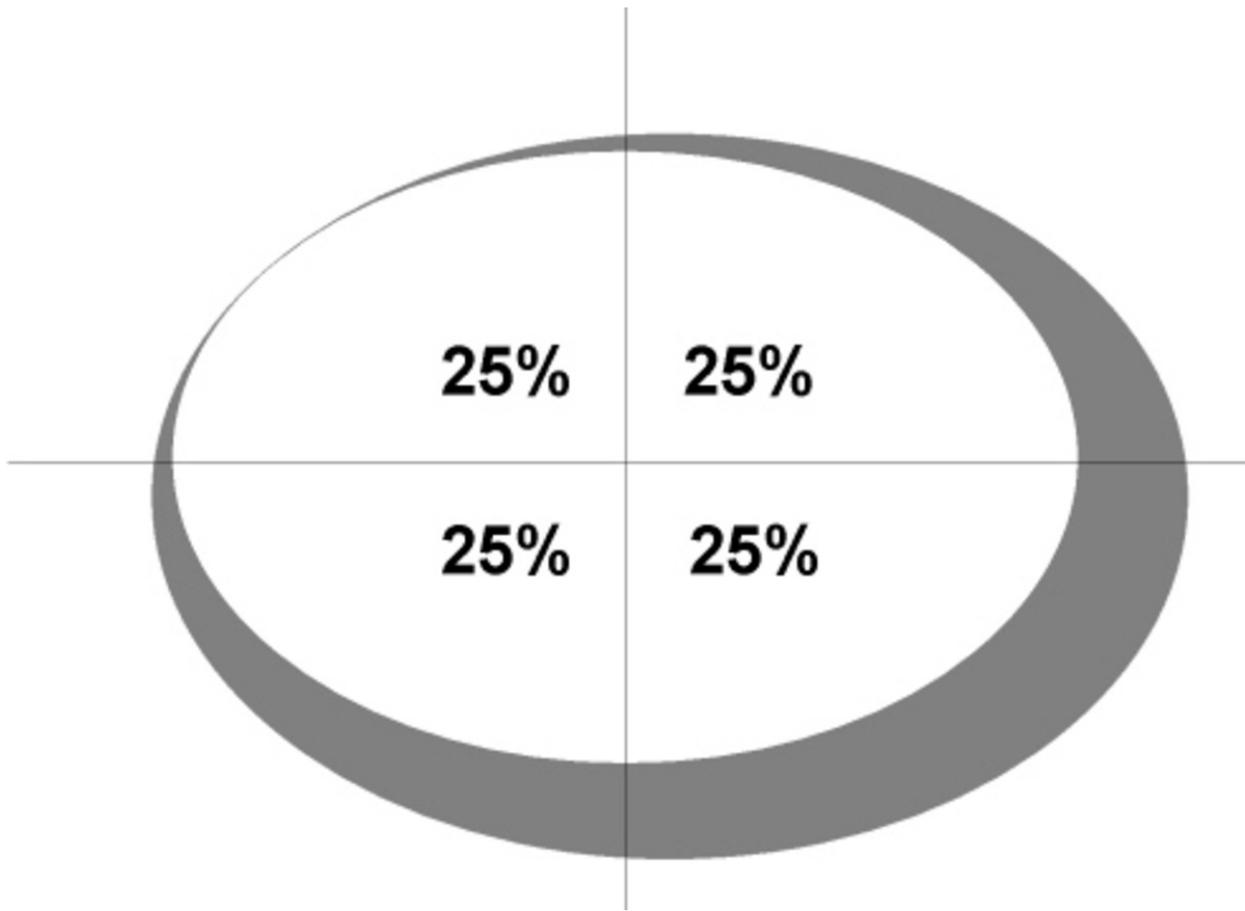


Fig. 10: Schematic Illustration of Asymmetrical Disc Bulge in Axial Plane

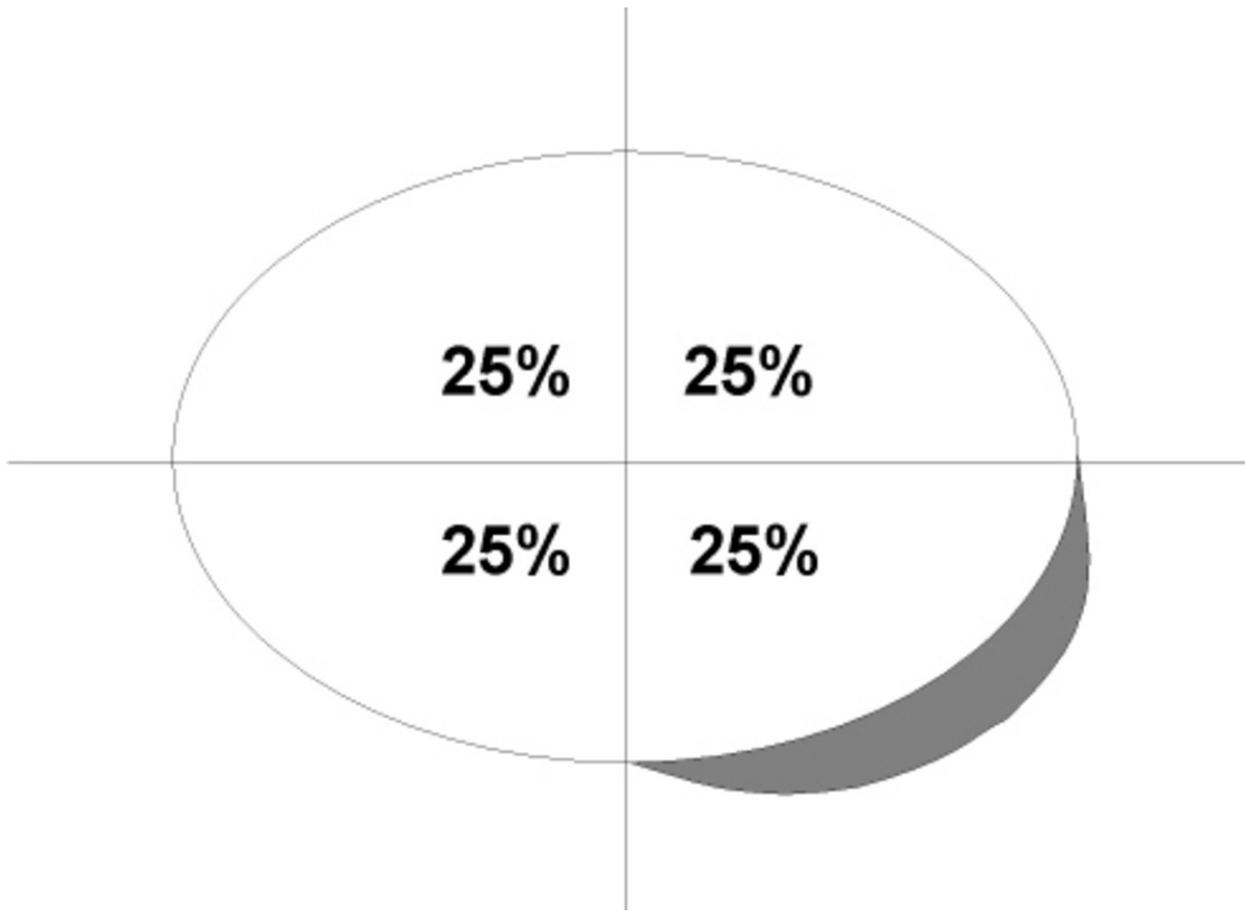


Fig. 23: Schematic Focal Disc Protrusion Illustration in Axial Plane

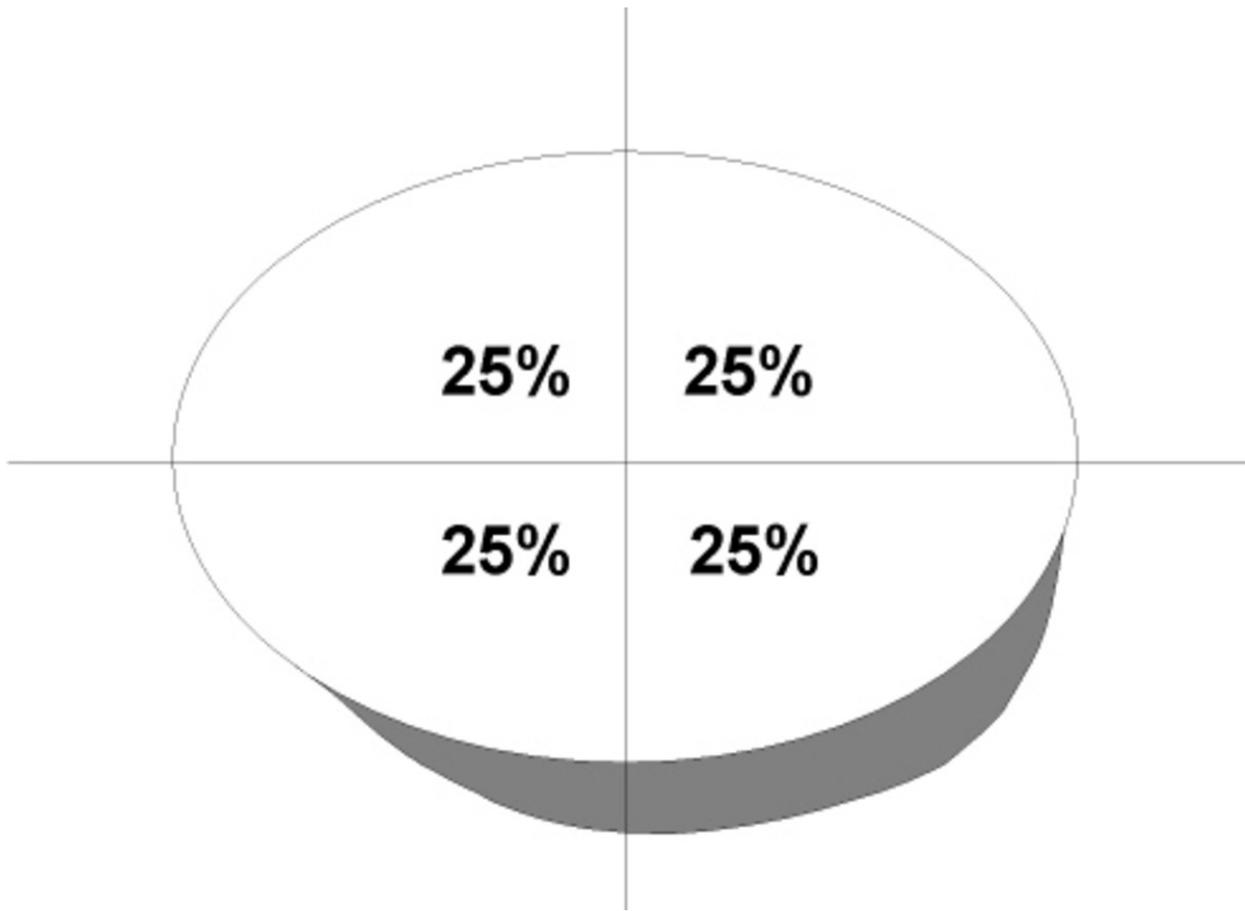


Fig. 26: Schematic Broad Based Disc Protrusion Illustration in Axial Plane

Findings and procedure details

Recommendations of correct nomenclature and classification of lumbar disc pathology in Magnetic Resonance Imaging were published in 2001 by Combined Task Force of the American Society of Spine Radiology, the American Society of Neuroradiology, and the North American Spine Society and subsequently endorsed by American Academy of Orthopaedic Surgeons, American Academy of Physical Medicine and Rehabilitation, American College of Radiology, American Society of Neuroradiology, American Society of Spine Radiology, Joint Section on Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and Congress of Neurological Surgeons, European Society of Neuroradiology, North American Spine Society, Physiatrix Association of Spine, Sports and Occupational Rehabilitation becoming the most recognised and accepted disc disease terminology lexicon.

Definitions proposed by consensus are based on the anatomy and pathology and not on the etiology or symptoms.

Disc disease diagnostic categories distinguished by Combined Task Force :

- Normal
- Congenital/Developmental Variation
- Traumatic/Degenerative
 1. - Annular tear: Radial, Concentric, Transverse
 2. - Degenerative: Spondylosis deformans, Intervertebral osteochondrosis.
 3. - Herniation: Protrusion, Extrusion
- Infectious/Inflammatory
- Neoplastic
- Morphological variant of uncertain significance.

One Disc can be affected by different pathologies.

As terminology describing Traumatic/Degenerative disc changes (especially disc herniations) are the most confusing and variable in correct interpretation in our educational exhibit we will present its correct classification and illustrate it on examples.

Annular Tear (Fissure)

- Defined as localised disruption of the disc annulus which extends:

radially - disruption of annular fibers extending from the nucleus outward toward the periphery of the annulus, usually in the vertical (cranio-caudal) plane, with occasional horizontal (transverse) components.

transversely - tear or fissure of the annulus, running in the axial plane (horizontally), usually limited to rupture of the outer annular attachments to the ring apophysis. Transverse tears are usually small and are located at the junction of the annulus and ring apophysis. [Fig. 2](#) on page 15

concentrically - separation, or break, of annular fibers, in a plane roughly parallel to the curve of the periphery of the disc, creating fluid-filled spaces between adjacent annular lamellae [Fig. 3](#) on page 16

- The term tear or fissure does not imply a traumatic aetiology of the lesion
- Seen as high signal in the posterior annulus fibrosus on T2-weighted images. ([Fig. 4](#) on page 17, [Fig. 5](#) on page 18, [Fig. 6](#) on page 19, [Fig. 7](#) on page 20)
- IV Gadolinium can enhance annular tears on T1-weighted images.

Disc Degeneration

- Broad term - includes a multitude of abnormalities including desiccation, fibrosis, narrowing of the disc space, bulge, extensive fissuring, mucinous degeneration of the annulus, defects/sclerosis of the endplates, osteophytes at the vertebral apophyses
- A disc demonstrating one or more of these degenerative changes can be further qualified into two sub-categories: spondylosis deformans and intervertebral osteochondrosis
- Intervertebral osteochondrosis (synonyms: deteriorated disc, chronic discopathy, osteochondrosis) involves degeneration vertebral body endplates, the nucleus pulposus, and the annulus fibrosus, which is characterized by disc space narrowing, vacuum phenomenon, and vertebral body reactive changes.
- Spondylosis deformans is degenerative process of the spine involving essentially the annulus fibrosus and characterized by anterior and lateral marginal osteophytes arising from the vertebral body apophyses, while the intervertebral disc height is normal or only slightly decreased
- The term degenerated disc, in itself, does not infer knowledge of cause, relationship to aging, presence of symptoms, or need for treatment.

Disc Bulge

- Generalised, eccentric expansion of the disc beyond the confines of the endplates involving greater than 50% or 180 degrees of the endplate

circumference, usually less than 3mm beyond the edges of the vertebral body apophyses in the axial plane.

- May be symmetric [Fig. 8](#) on page 21, [Fig. 9](#) on page 22 or asymmetric.
- In asymmetric bulge outer annulus is beyond the plane of the disc space more evident in one section of the periphery of the disc than another - **but not sufficiently focal to be characterized as a protrusion** [Fig. 10](#) on page 23, [Fig. 11](#) on page 24
- Not considered a form of herniation as there is no annulus fibrous rupture.
- Descriptive (but not diagnostic) term of disc shape.
- The mildest disc bulges simply result in the loss of the slightly concave appearance to the posterior disc margin on axial images, and this appearance may be considered a normal variant at L5-S1.

Disc Herniation

Displacement of disc material beyond the limits of the intervertebral disc space

Location :

- Axial plane zones [Fig. 12](#) on page 25

- Central zone [Fig. 13](#) on page 26

NOTE: The center of the central zone is a sagittal plane through the center of the vertebral body.

The zones to either side of the center plane are right central and left central, which are preferred terms when the side is known. [Fig. 14](#) on page 44

- Subarticular (lateral recess) zone [Fig. 15](#) on page 27

NOTE: The subarticular zone cannot be precisely delineated because the structures that define the planes of the zone are irregular.

The lateral recess refers more appropriately to the space beneath the facet at the pedicular level than as synonymous with the entire subarticular zone.

- Forminal zone [Fig. 17](#) on page 29

NOTE: Sometimes called the "pedicle zone," which can be confusing because pedicle zone might also refer to measurements in the sagittal plane between the upper and lower surface of a given pedicle, which is properly called the pedicle level.

Foraminal zone also may be reported as "lateral zone," which again can cause confusion as lateral zone can also mean extra-foraminal zone or an area including both the foraminal and extra-foraminal zones.

- Extraforaminal (far lateral) zone [Fig. 18](#) on page 30
- Anterior zone [Fig. 19](#) on page 32

Disc herniations can occupy more than one zone [Fig. 16](#) on page 28

NOTE : Term Paracentral refers to herniation in the right or left central zone of the vertebral canal.

The terms right central or left central are preferable when speaking of a single site when the side can be specified

Paracentral is appropriate if the side is not significant or when speaking of mixed sites.

- Craniocaudal (sagittal) plane levels [Fig. 20](#) on page 32 -

- Disc level - confined to between the vertebral endplates
- Suprapedicular level - between superior endplate and superior border of pedicle
- Pedicle level - at the level of the pedicle
- Infrapedicular level - below lower margin of the pedicle to the inferior endplate.

NOTE: Infrapedicular level herniation - usually from disc level below and extruded superiorly

Suprapedicular level herniation - usually from the disc level above and extruded inferiorly

Occasionally disc fragment may migrate large distance cephalo-caudal

NOTE: Distinction should be made between designation of the pedicular level in the sagittal plane and the "foraminal zone" which is defined by the planes of the medial and lateral walls of the pedicles in the axial plane.

Volume of Displaced Material

- mild - medullary canal compromise less than 1/3 [Fig. 21](#) on page 45
- moderate - medullary canal compromise between 1/3 and 2/3 [Fig. 22](#) on page 46, [Fig. 25](#) on page 35
- severe - medullary canal compromise more than 2/3. [Fig. 30](#) on page 40

The same grading can be applied for foraminal involvement.

Disc herniations may be further specifically described as:

- contained (sub - anular herniation) when displaced disc tissue is wholly within an outer perimeter of uninterrupted outer anulus or capsule
- uncontained when displaced disc material is not contained by outer anulus

Disc Herniation - Protrusion

- Described when the greatest plane in any direction between the edges of the protruded disc material beyond the disc is less than the distance between the edges of the base. [Fig. 28](#) on page 42
 - **Focal** - base less than 25% (90 degrees) of disc circumference [Fig. 23](#) on page 33, [Fig. 24](#) on page 34, [Fig. 25](#) on page 35
 - **Broad based** - base 25-50% (90 - 180 degrees) of disc circumference [Fig. 26](#) on page 36, [Fig. 27](#) on page 44

Disc Herniation - Extrusion

- Described when at least one plane of any one distance between the edges of the disc material beyond the disc space is greater than the distance between the edges of the base measured in the same plane [Fig. 29](#) on page 41, [Fig. 30](#) on page 40, [Fig. 31](#) on page 40
- May have a migrated fragment, if there is disc material which is displaced away from the site of the extrusion, and can be either above or below the disc space [Fig. 32](#) on page 47

NOTE : Migration refers to the position of the displaced disc material, rather than to its continuity with disc tissue within the disc of origin, therefore, it is not synonymous with sequestration. [Fig. 32](#) on page 47

- Can be further specified as a sequestration if the displaced disc material has completely lost continuity with the parent disc [Fig. 33](#) on page 38, [Fig. 34](#) on page 37

NOTE: When referring to the condition of the disc, categorization as extruded with sub-categorization as sequestered is preferred, whereas free fragment or sequestrum is appropriate when referring specifically to the fragment.

Sequestered disc and free fragment are virtually synonymous

Characteristics of protrusion and extrusion may co-exist, in which case the disc should be subcategorized as extruded

Intra-vertebral herniation: A disc in which a portion of the disc is displaced through the end-plate into the centrum of the vertebral body.

Controversial Definitions

Disc Prolapse

- It has been used often non-specifically as synonymous with herniation.
- Prolapse is not a recommended term for description of disc displacement.

Herniated nucleus pulposus

- Inaccurate term and *Herniated Disc* is preferred as displaced disc tissues often include cartilage, bone fragments, or anular tissues.

Ruptured Disc

- wrongly used synonymously with herniated disc
- colloquial term
- can be easily confused with violent, traumatic rupture of the anulus or end-plate

Chronic Disc Herniation

- Disc herniation with presence of calcification, ossification, or gas accumulation within the displaced disc material, suggesting that the herniation is not of recent origin.
- Not to be used for herniations of soft disc material, regardless of the duration of displacement.

High Intensity Zone

- area of high signal intensity on T2-weighted magnetic resonance images of the disc, usually referring to the outer anulus
- may reflect fissure or tear of the anulus, but do not imply knowledge of etiology, concordance with symptoms, or need for treatment.

Intra-anular Herniation

- Wrongly sometimes used for description of intra-anular displacement of predominantly nuclear tissue to a more peripheral site within the disc space, usually into a fissure in the annulus.
- Intra-anular displacement is a form of internal disruption.
- When referring to intra-anular displacement, it is best not to use the term "herniation" in order to avoid confusion with disc herniation.

Images for this section:

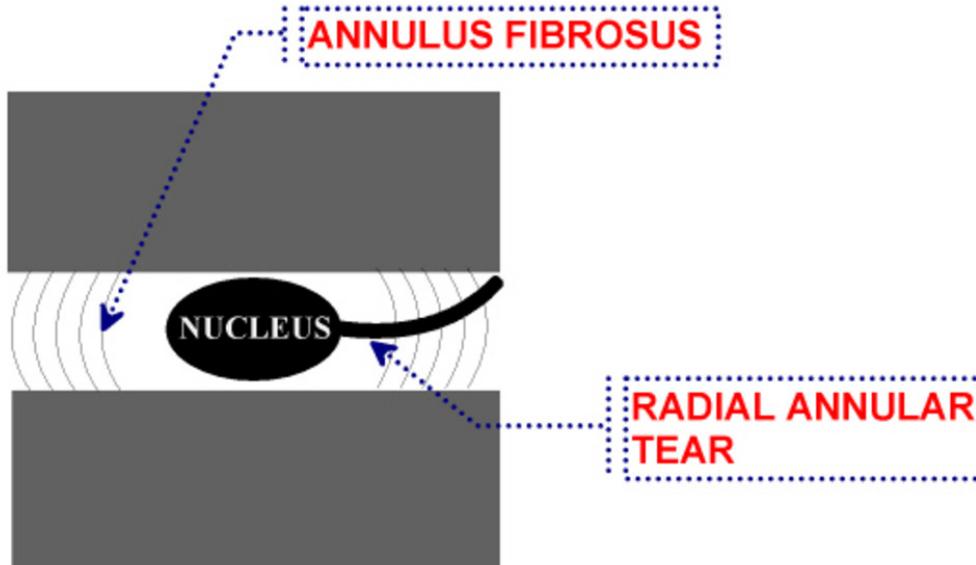


Fig. 1: Schematic Illustration of Radial Annular Tear in Sagittal Plane

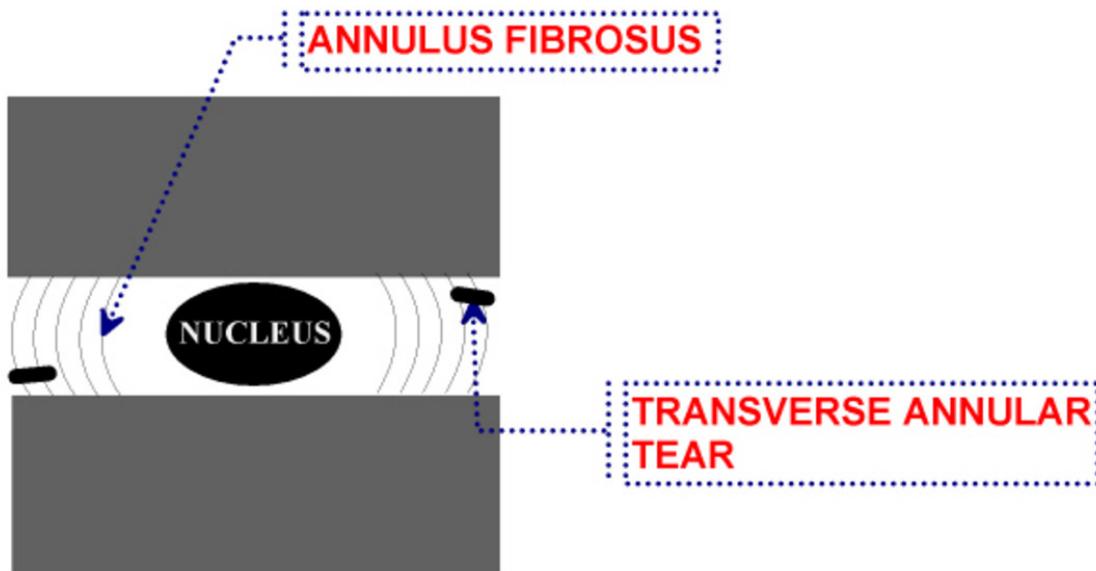


Fig. 2: Schematic Illustration of Transverse Annular Tear in Sagittal Plane

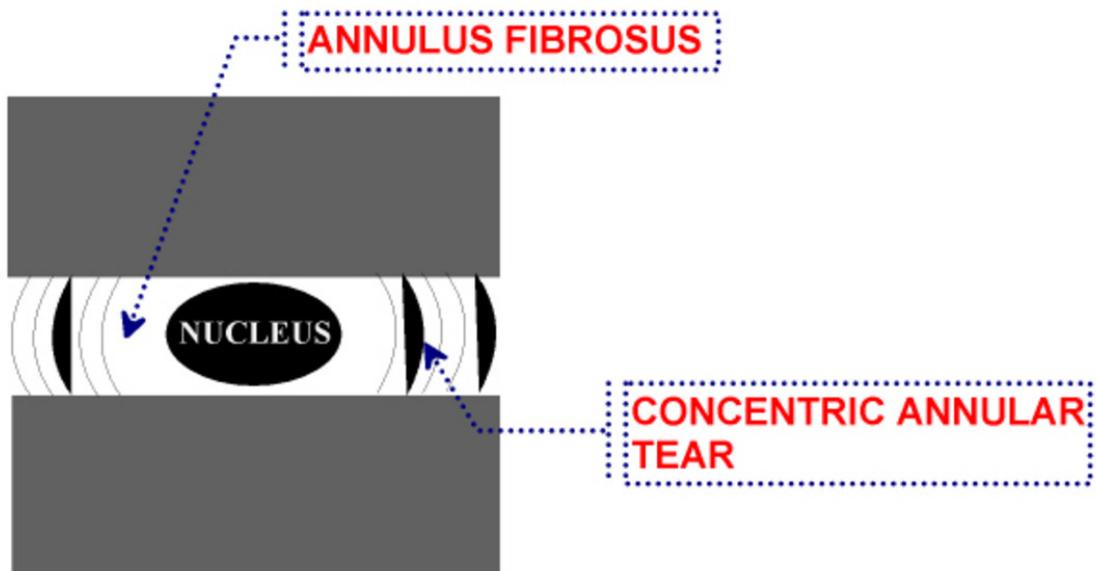


Fig. 3: Schematic Illustration of Concentric Annular Tear in Sagittal Plane



Fig. 4: Axial T2 Weighted Lumbar Spine MRI. L3/L4 Central Annular Fissure with Diffuse Disc Bulge



Fig. 5: Sagittal T2 Weighted Lumbar Spine MRI image demonstrating focal hyperintensity at the posterior margin of L3/L4 compatible with Central Annular Fissure. L4/L5, L5/S1 Disc Protrusions



Fig. 6: Axial T2 Weighted Lumbar Spine MRI image showing L4/L5 Central Transverse Annular Disc Tear With Diffuse Disc Bulge

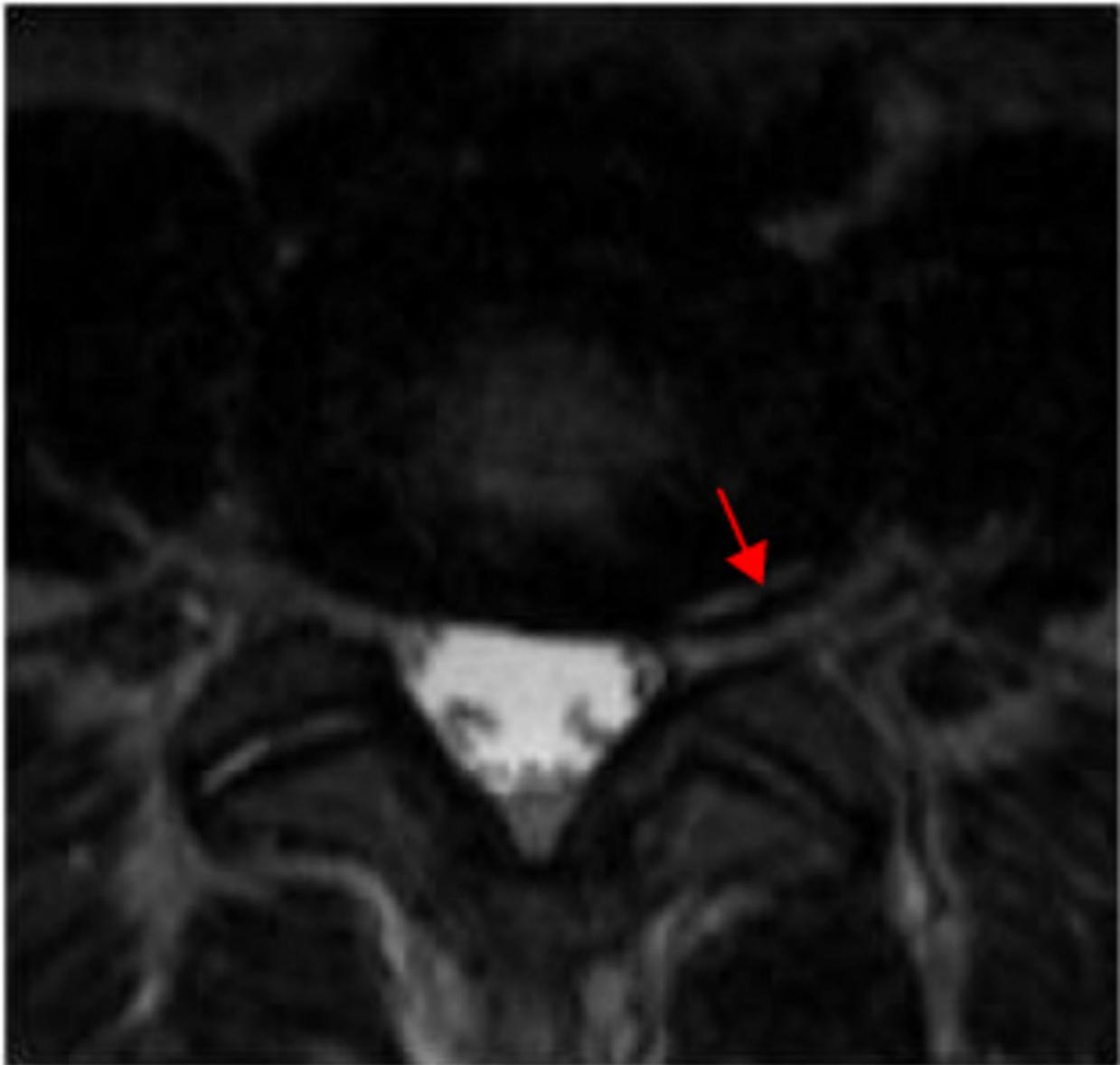


Fig. 7: Axial T2 Weighted Lumbar Spine MRI. Lateral Annular Tear

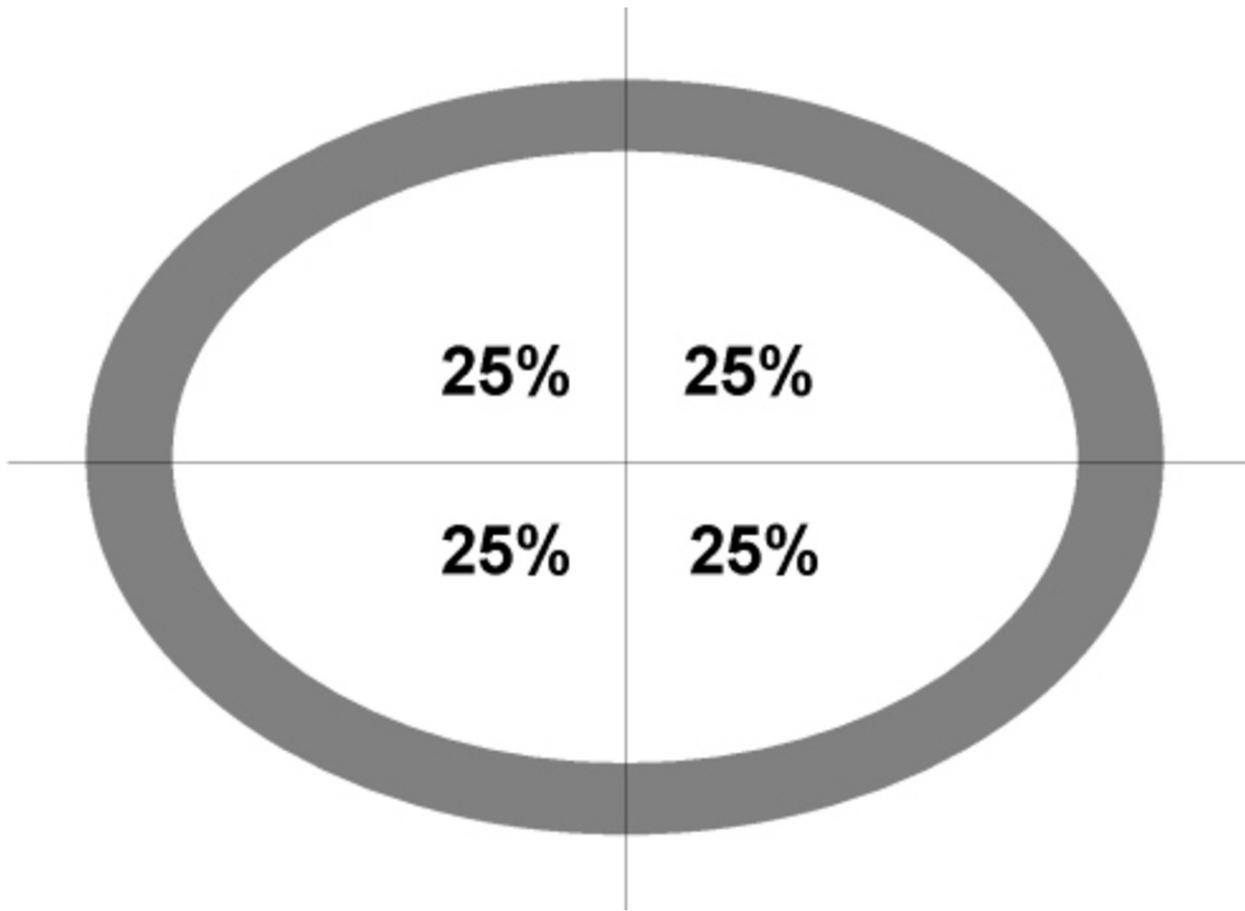


Fig. 8: Schematic Illustration of Symmetrical Disc Bulge in Axial Plane

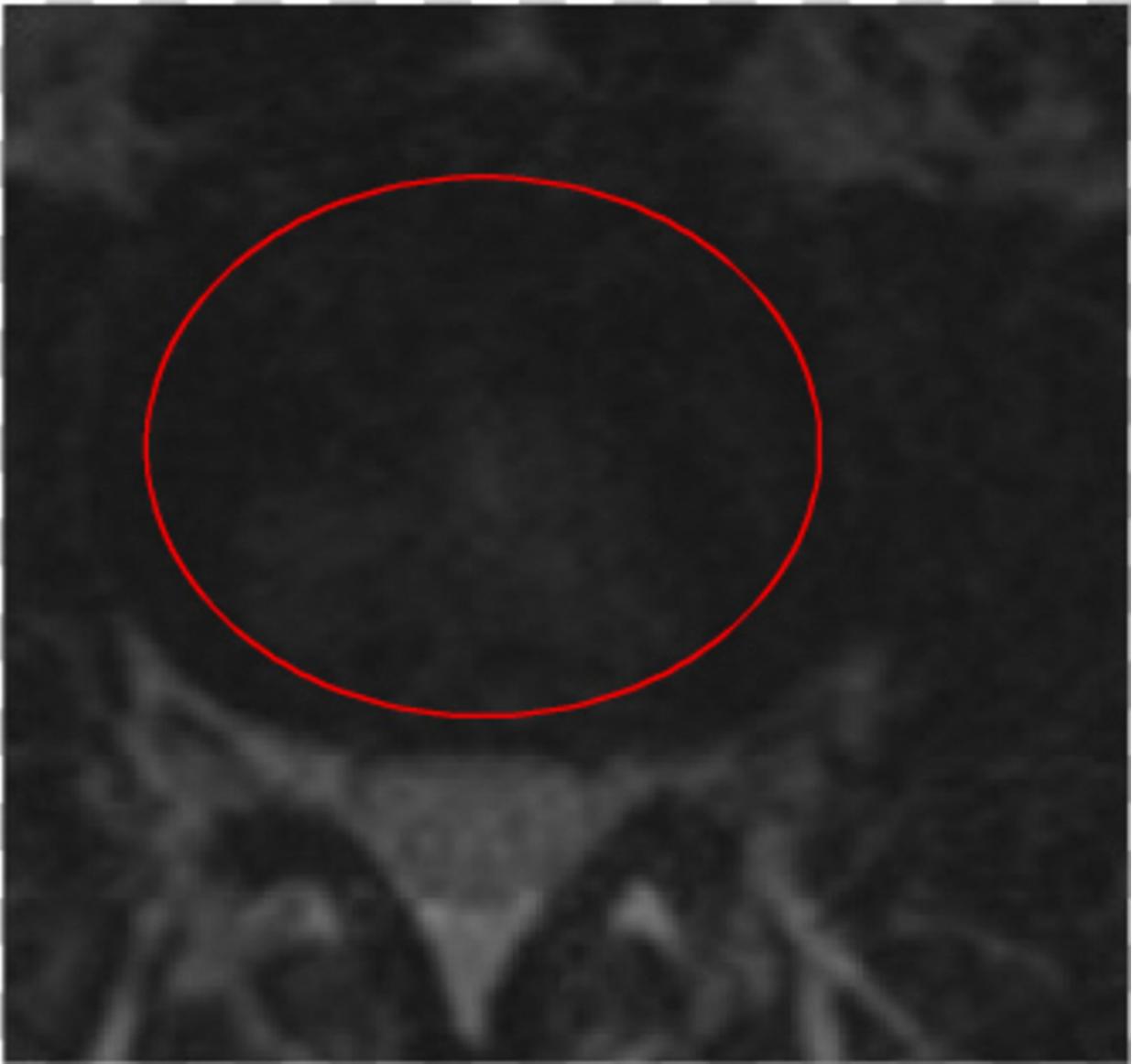


Fig. 9: Axial T2 Weighted Lumbar Spine MRI. Symmetrical Disc Bulge

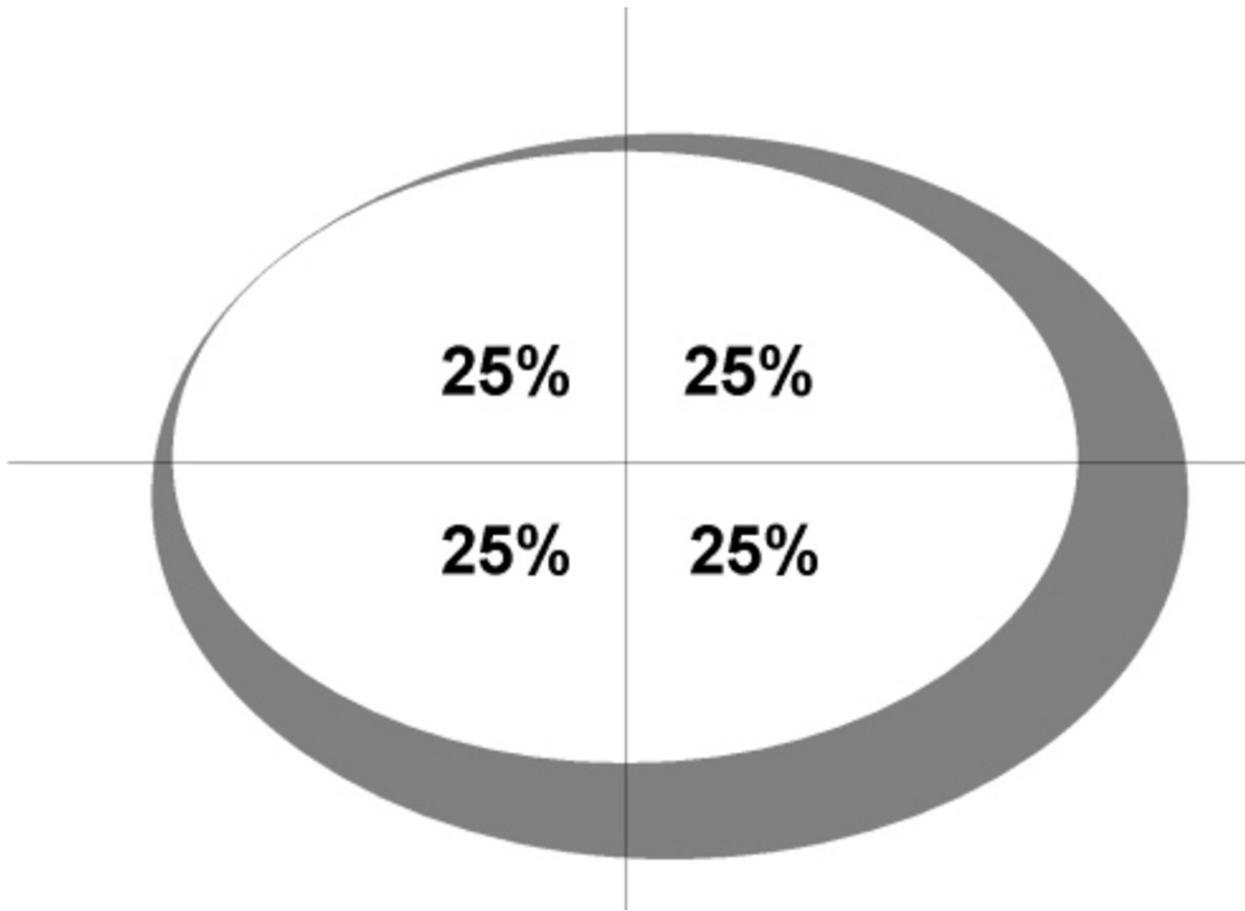


Fig. 10: Schematic Illustration of Asymmetrical Disc Bulge in Axial Plane

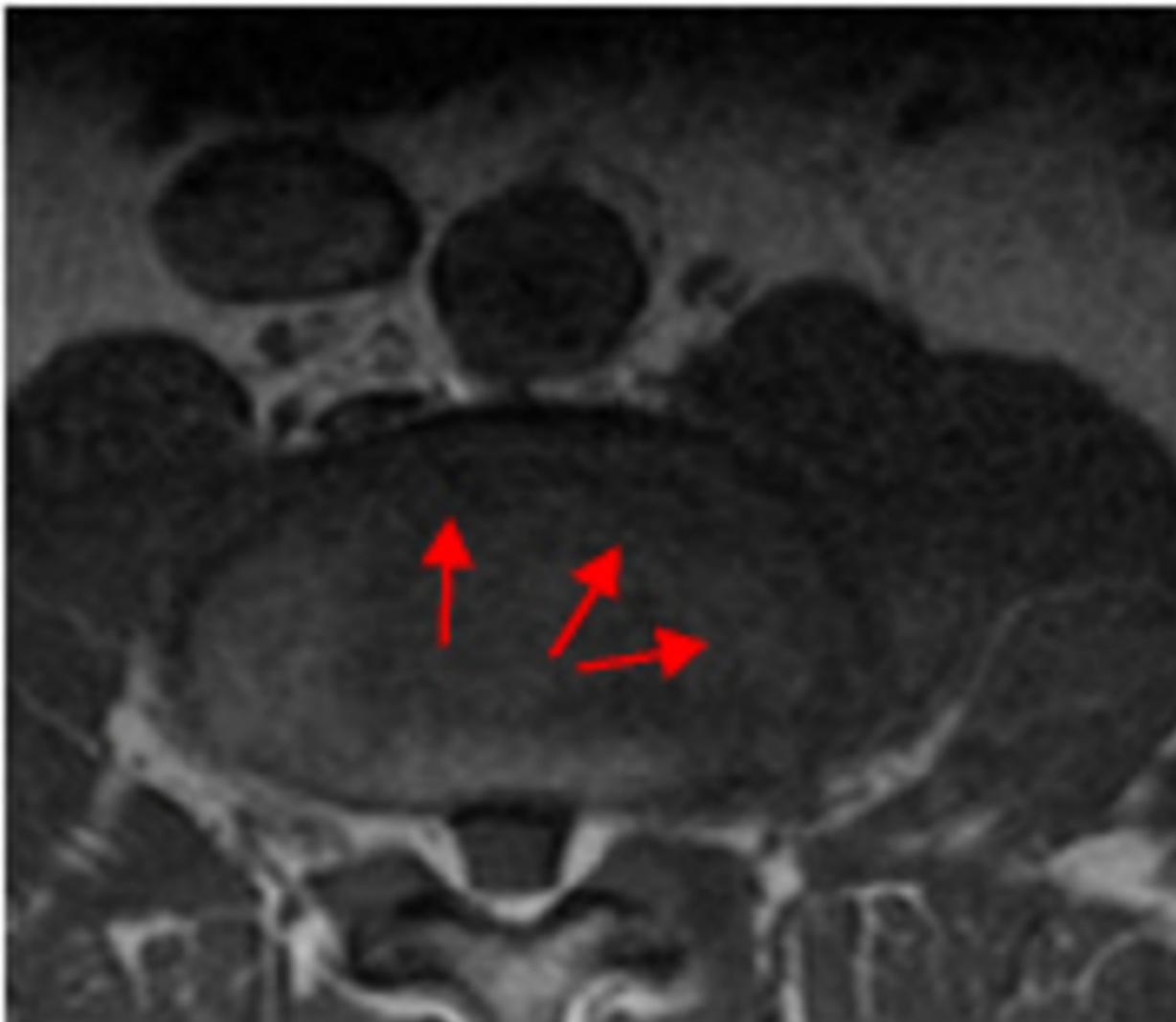


Fig. 11: Axial T2 Weighted Lumbar Spine MRI image showing Asymmetrical Disc Bulge (> 50% (180 degree) of disc circumference)

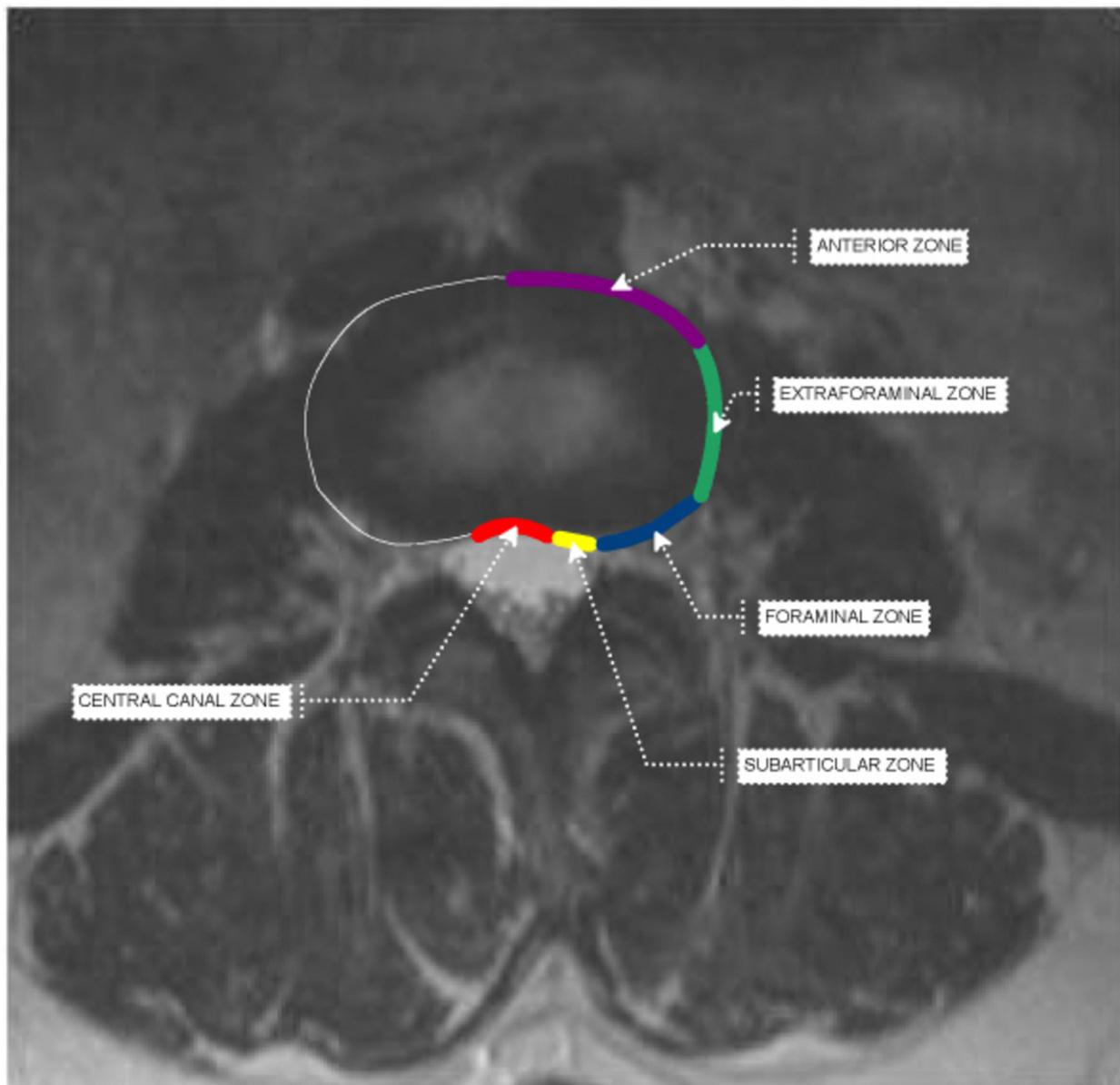


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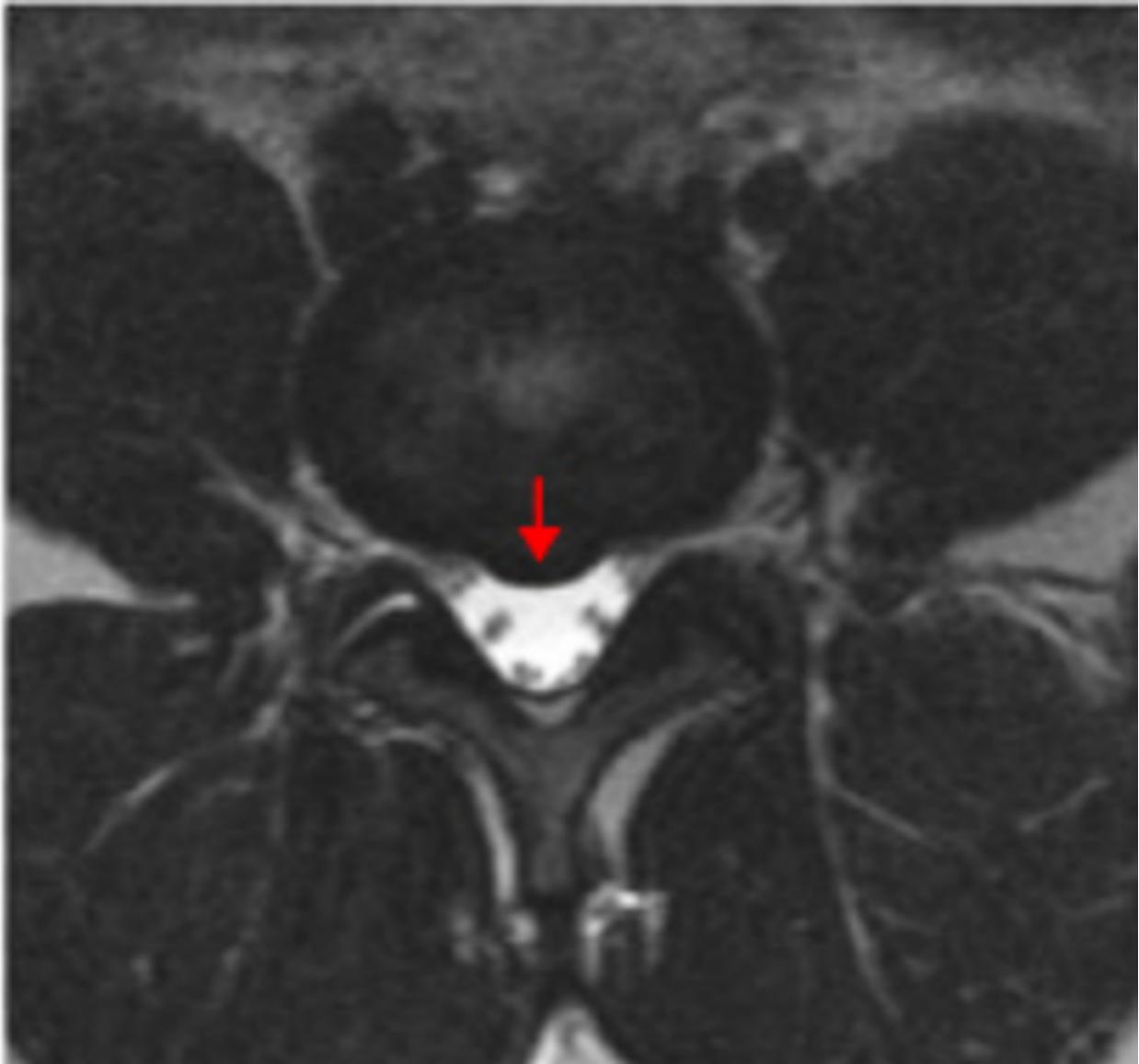


Fig. 13: Axial T2 Weighted Lumbar Spine MRI image showing L4/L5 Focal Posterior Central Disc Herniation - Protrusion

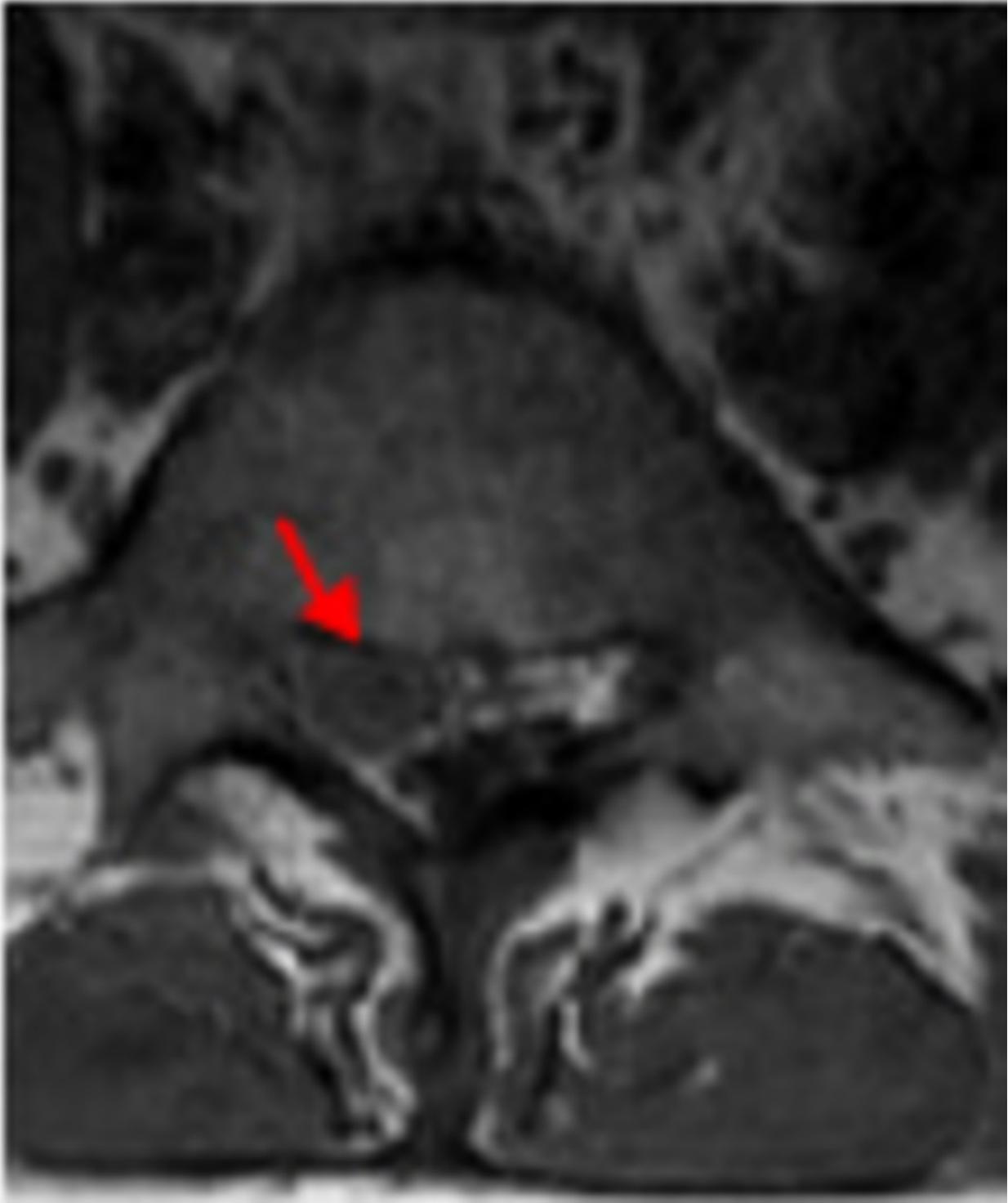


Fig. 15: Axial T2 Weighted Lumbar Spine MRI image showing Right Subarticular Disc Herniation

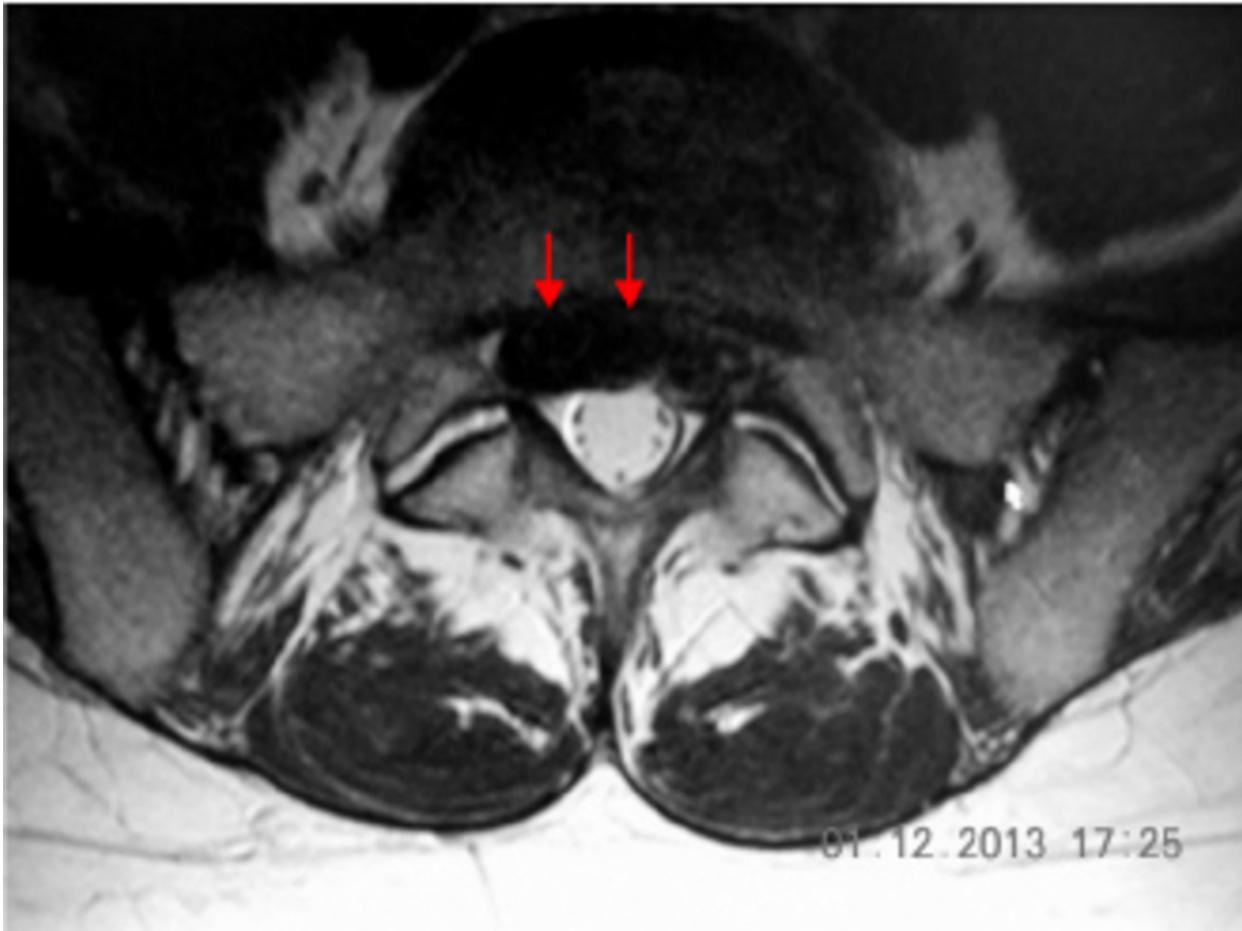


Fig. 16: Axial T2 Weighted Lumbar Spine MRI. Central Disc Herniation Extending To Right Subarticular Zone

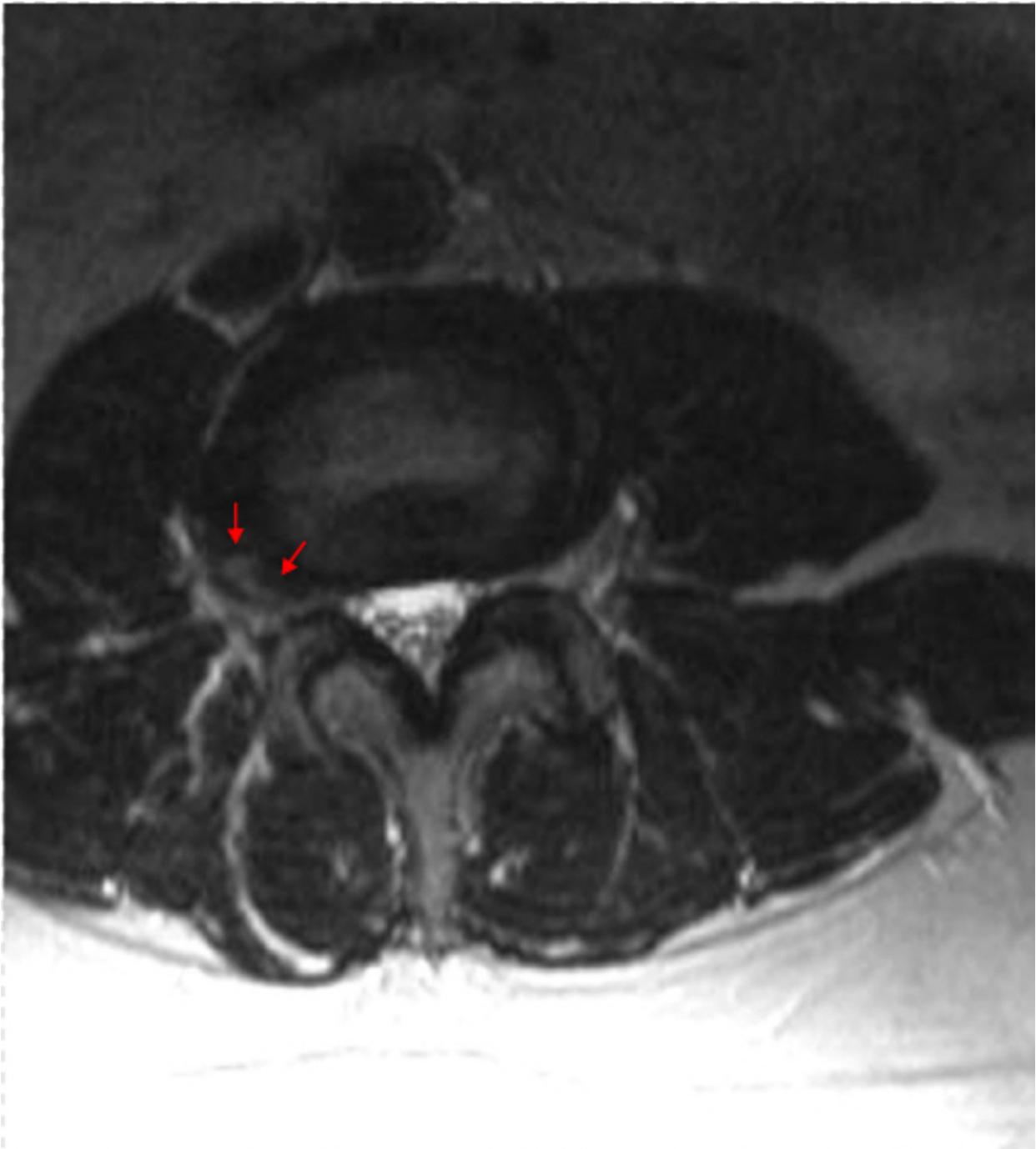


Fig. 17: Axial T2 Weighted Lumbar Spine MRI. Right Foraminal Disc Herniation



Fig. 18: Axial T2 Weighted Lumbar Spine MRI. Left Extraforaminal (far lateral) Disc Herniation



Fig. 19: Lumbar spine MRI image showing L4/L5 anterior disc herniation.

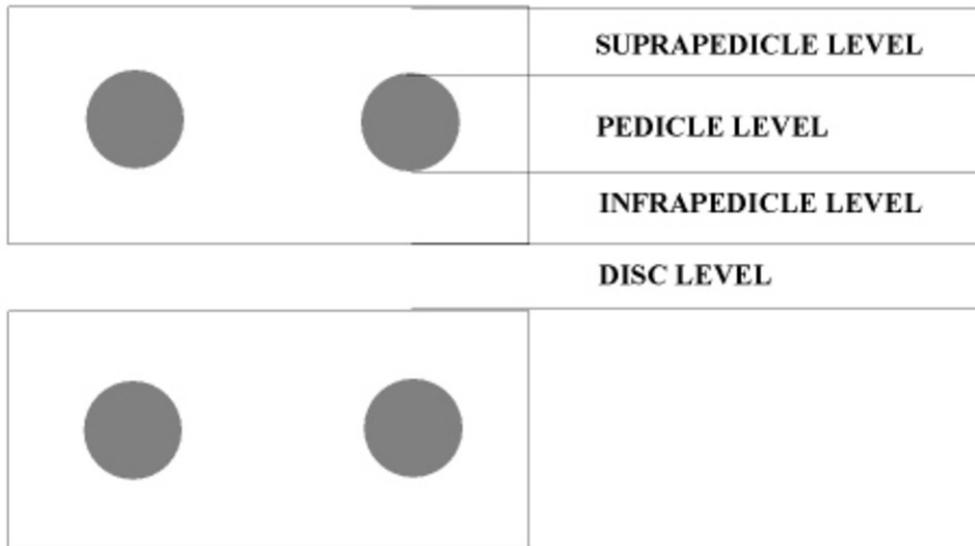


Fig. 20: Schematic Illustration showing representation of the anatomical disc herniation Levels in sagittal plane

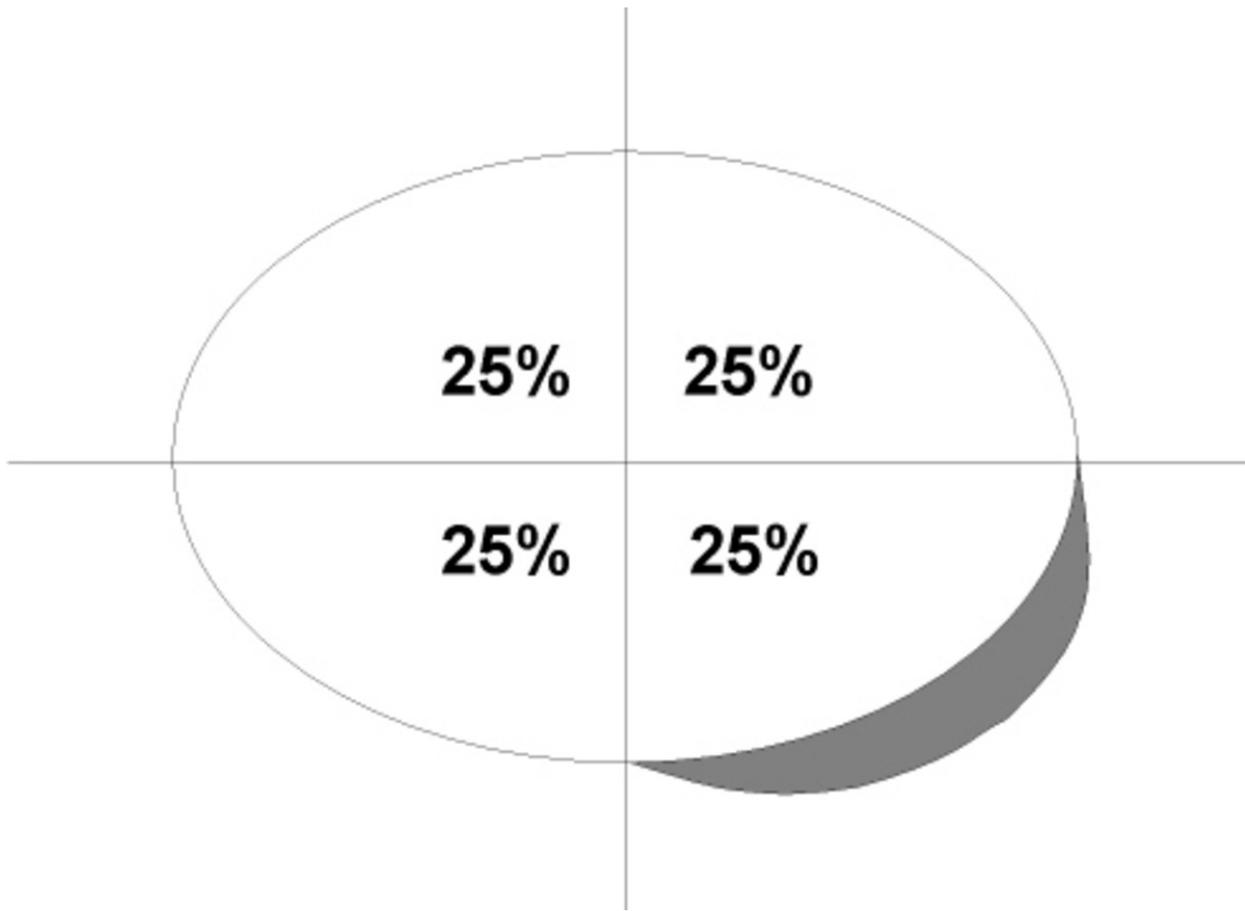


Fig. 23: Schematic Focal Disc Protrusion Illustration in Axial Plane

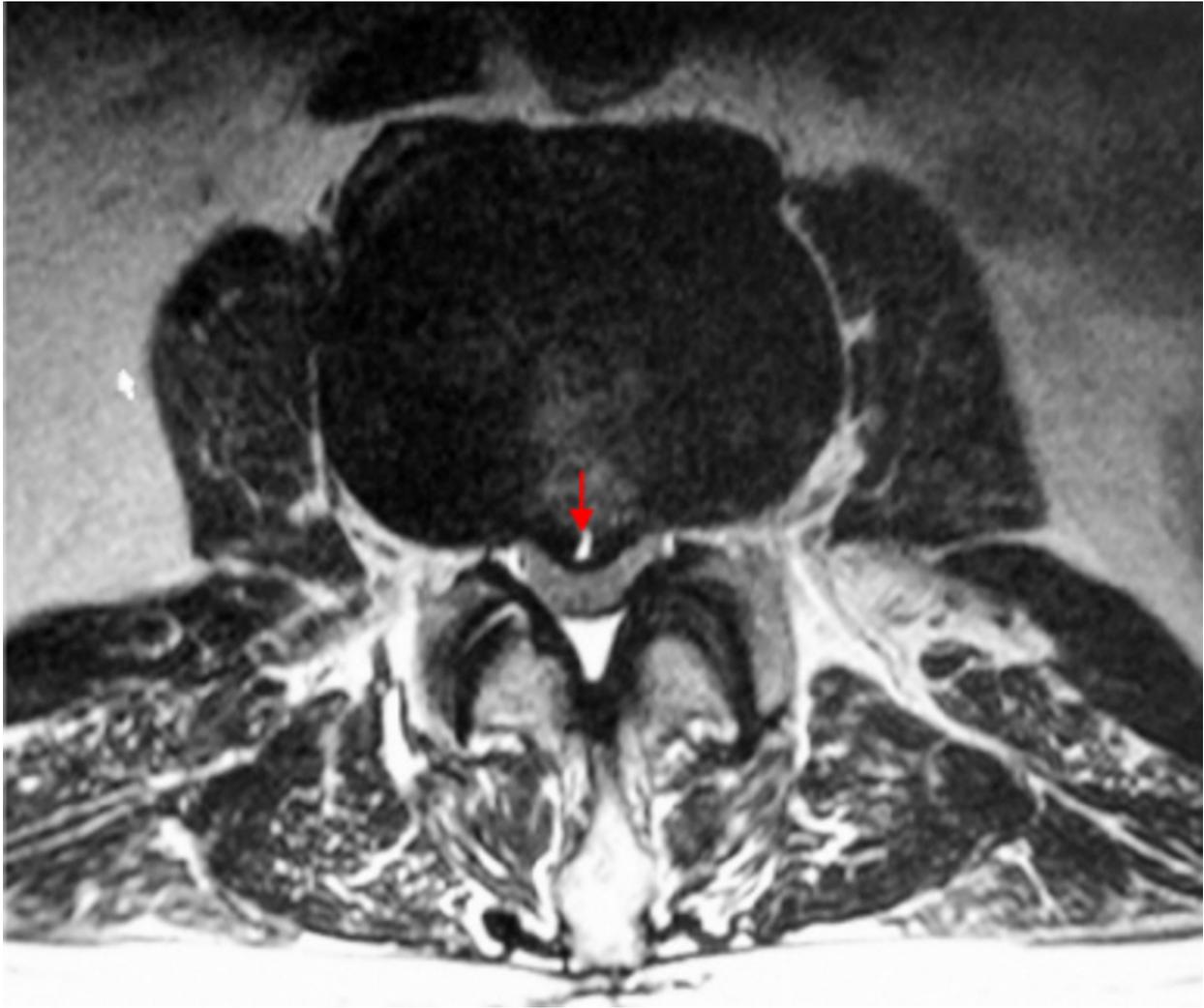


Fig. 24: Axial T2 Weighted Lumbar Spine MRI image showing L2/L3 Central Focal Disc Protrusion With Central Annular Disc Tear Distorting The Thecal Sac At This Level

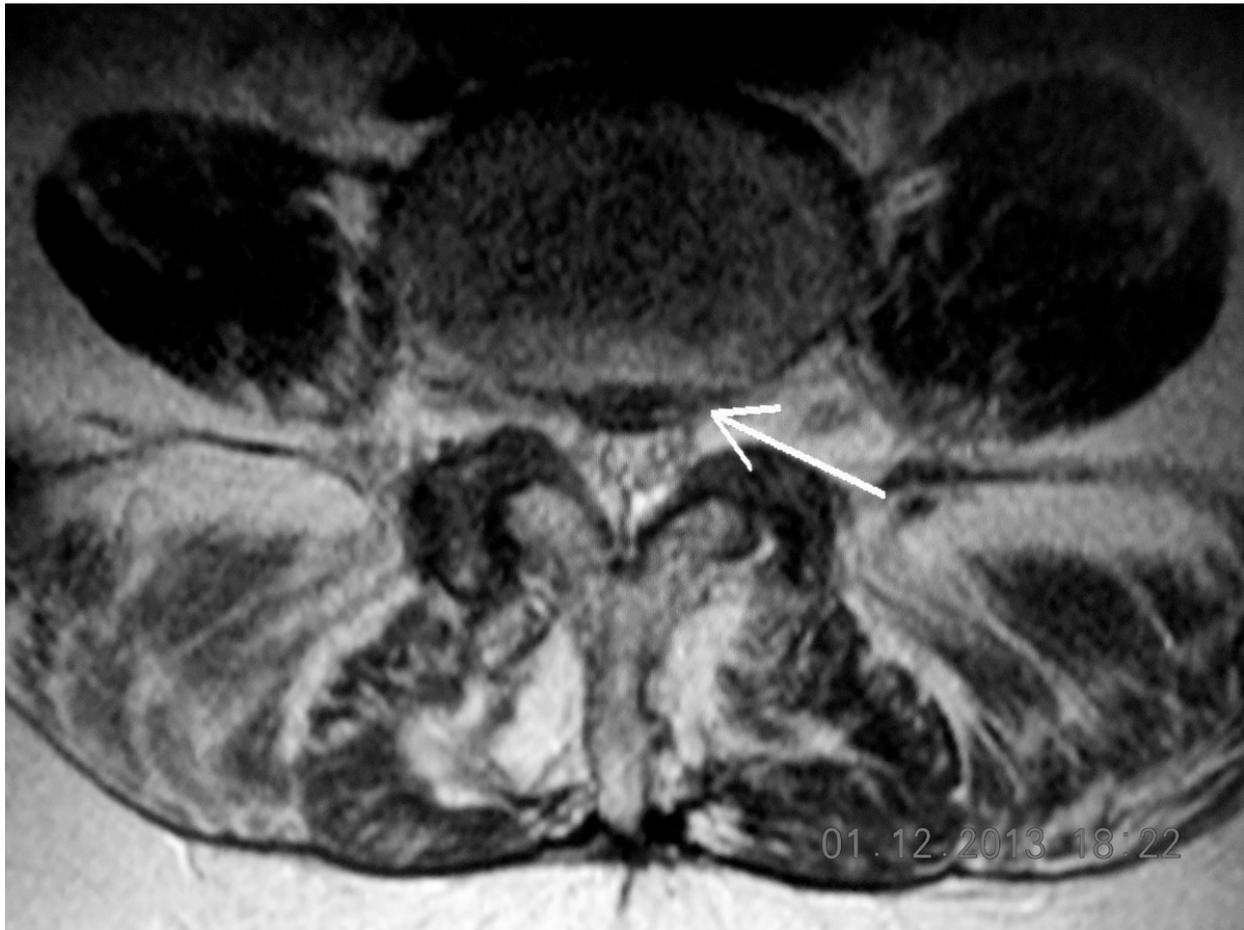


Fig. 25: Axial T2 Weighted Lumbar Spine MRI image showing L3/L4 Central Focal Disc Protrusion With Moderate Canal Stenosis

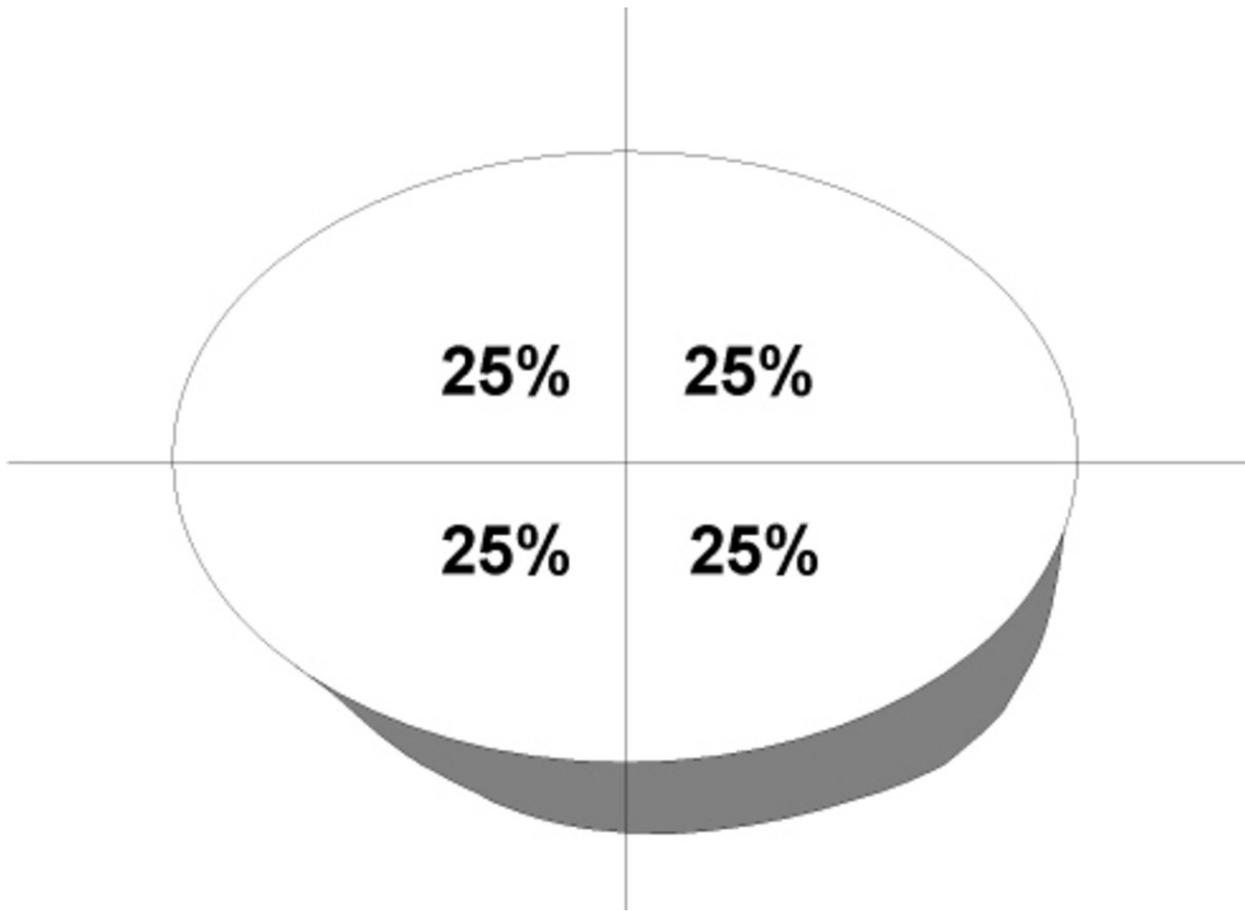


Fig. 26: Schematic Broad Based Disc Protrusion Illustration in Axial Plane

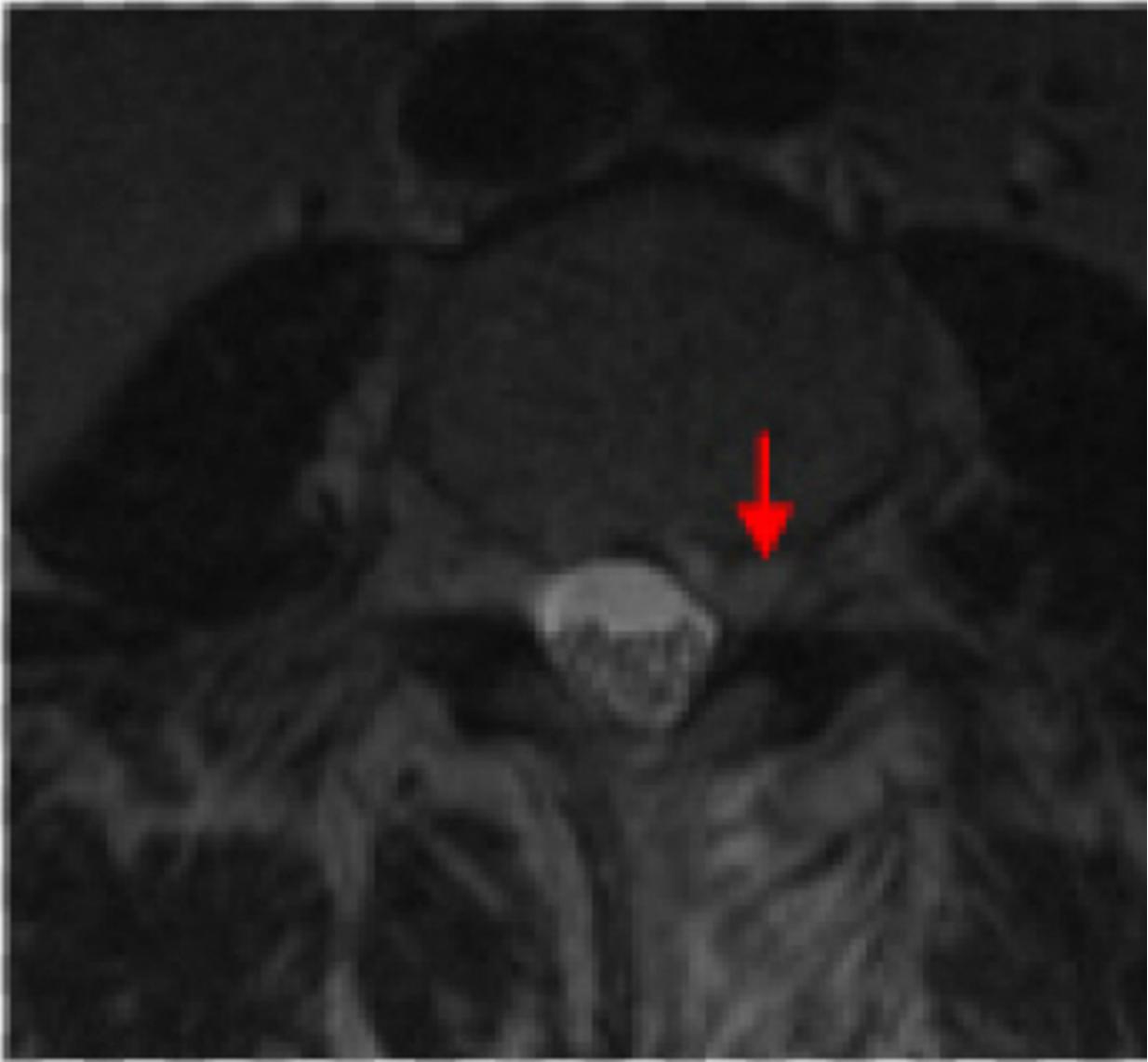


Fig. 34: Axial T2 Weighted Lumbar Spine MRI image showing Sequestered Disc Fragment

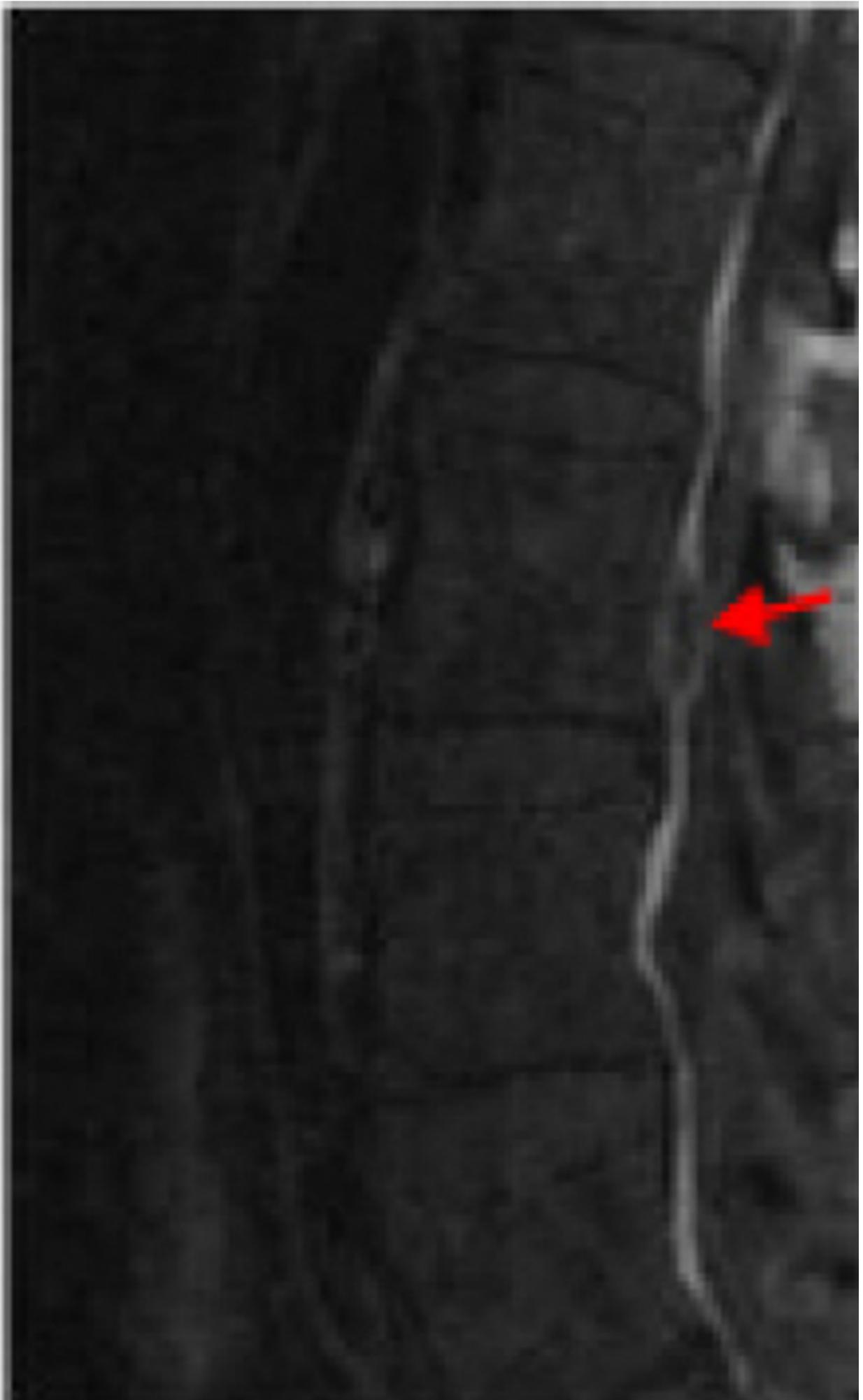


Fig. 33: Sagittal T1 Weighted Lumbar Spine MRI image showing Sequestered Disc Fragment



Fig. 31: Sagittal T1 Weighted Lumbar Spine MRI. Large L4/L5 Disc Extrusion

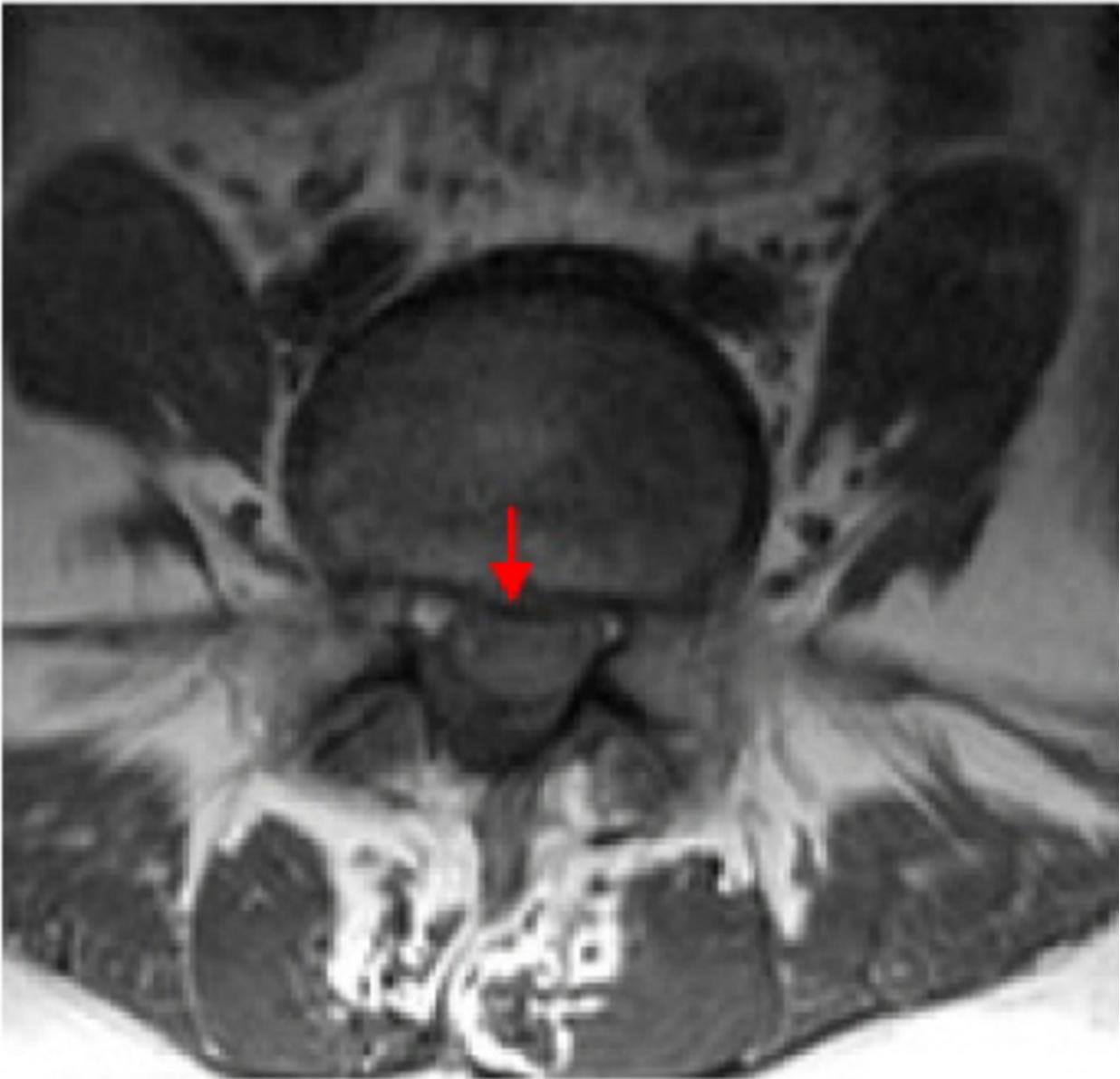


Fig. 30: Axial T1 Weighted Lumbar Spine MRI image showing L4/L5 Large Disc Extrusion with severe canal compromise.

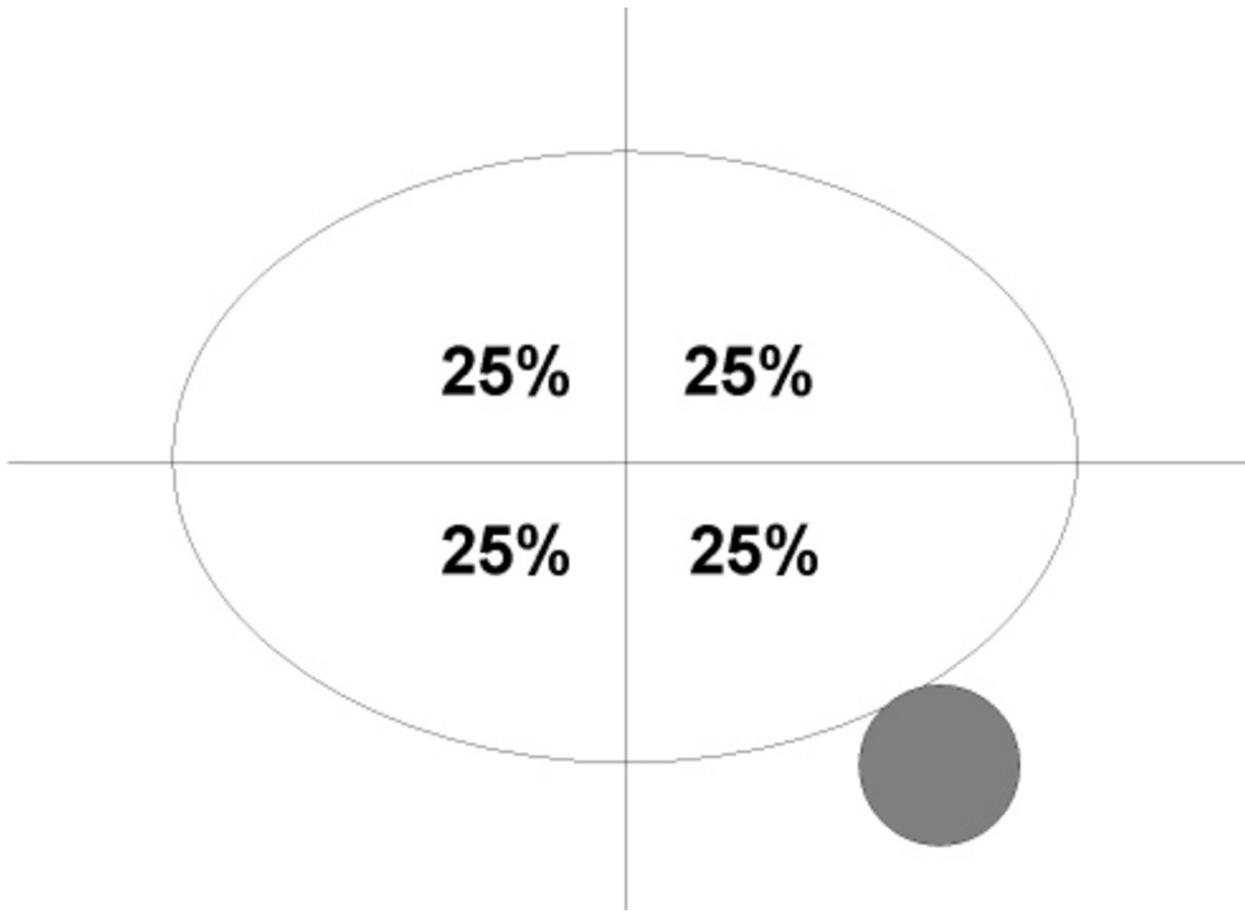


Fig. 29: Schematic Disc Extrusion Illustration in Axial Plane.



Fig. 28: Sagittal T2 Weighted Lumbar Spine MRI image showing L5/S1 Disc Protrusion.



Fig. 27: Axial T2 Weighted Lumbar Spine MRI image showing L3/L4 Broad Based Disc Protrusion.

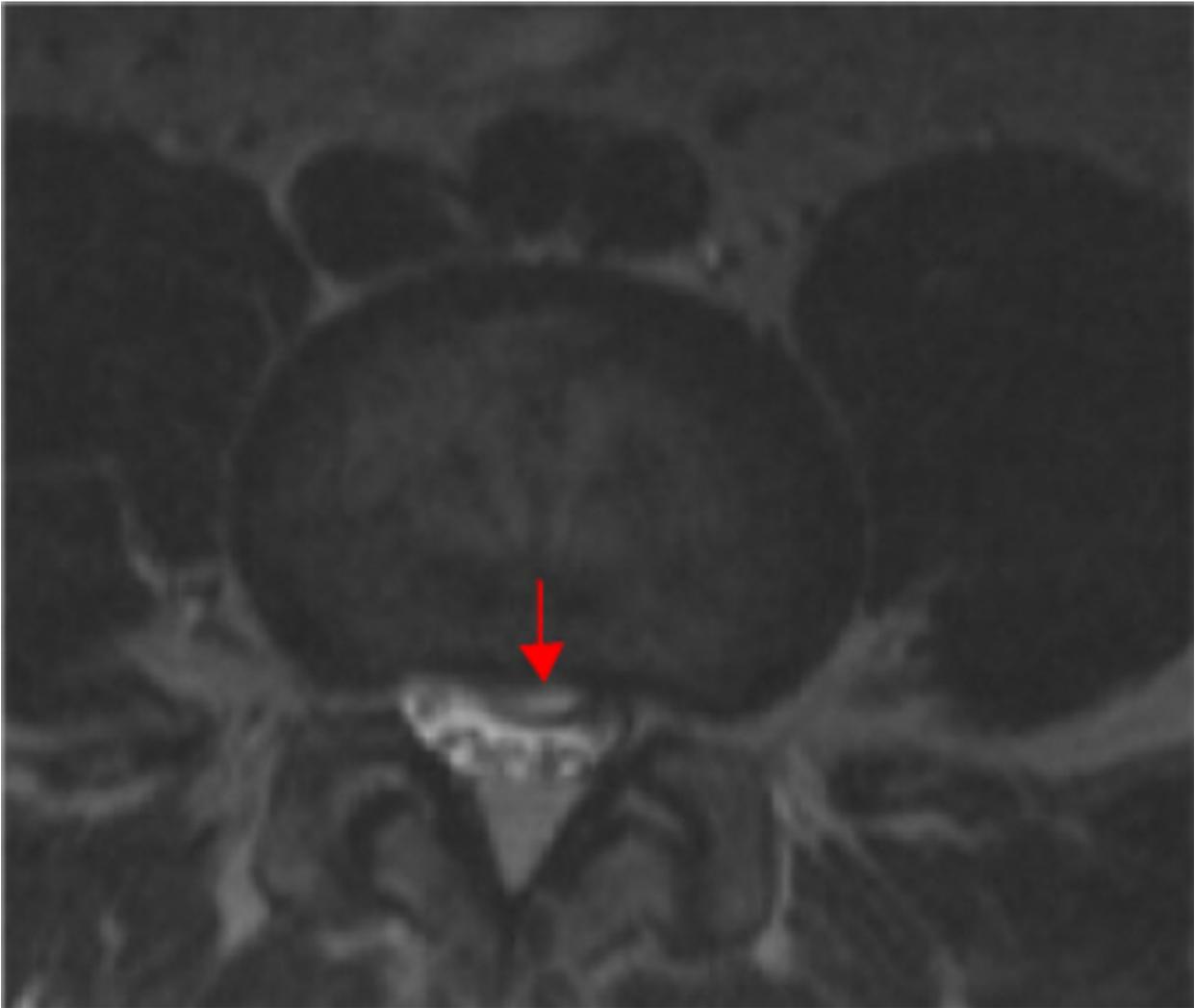


Fig. 14: Axial T2 Weighted Lumbar Spine MRI image showing Left Central Disc Herniation

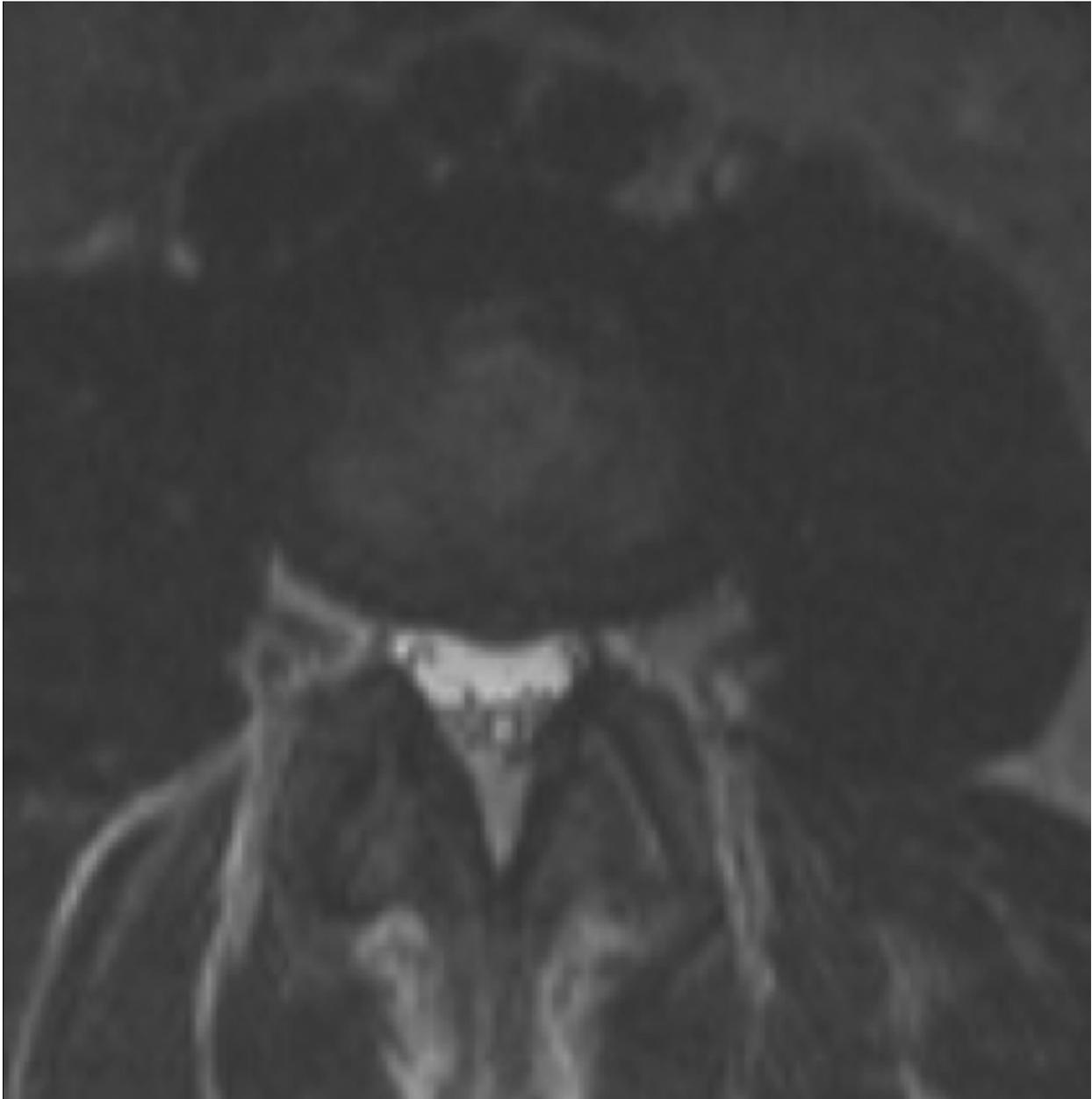


Fig. 21: Axial T2 weighted Lumbar Spine MRI image showing small disc protrusion with mild canal compromise.

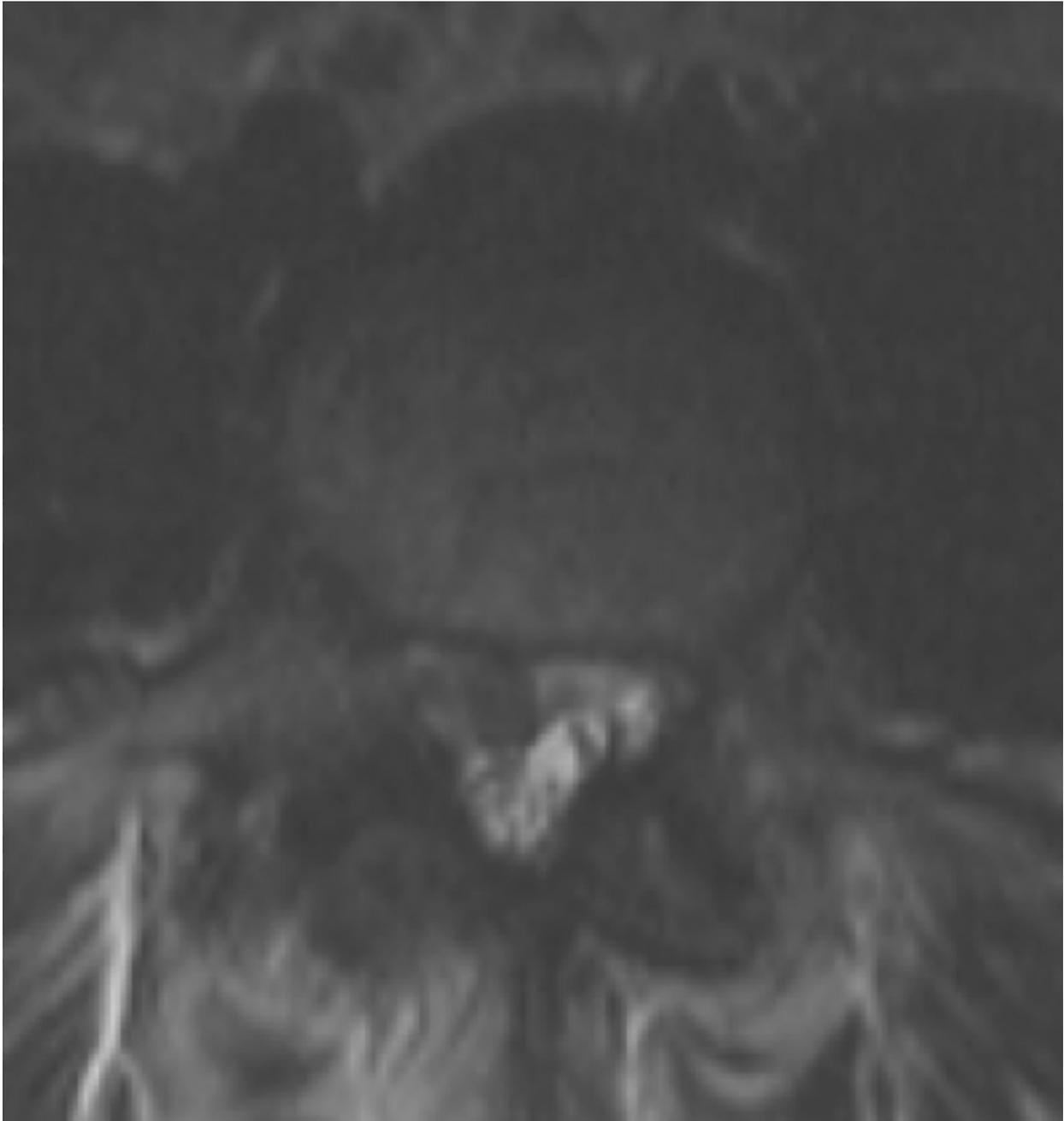


Fig. 22: Axial T1 Weighted Lumbar Spine MRI image showing moderate size disc herniation with moderate disc compromise.



Fig. 32: Sagittal T2 Weighted Lumbar Spine MRI image showing L4/L5 Extrusion With Inferior Migration

Conclusion

Nomenclature recommendations of lumbar disc pathology was published in 2001 by the Combined Task Force of the American Society of Spine Radiology, the American Society of Neuroradiology, and the North American Spine Society and subsequently supported by other professional organizations and scientific societies becoming the most recognised and accepted disc disease terminology lexicon.

Despite multiple articles published in recent years quoting standardized terminology recommendations from 2001 there is still a wide variety of radiological interpretation of what constitutes a particular disc pathology.

Lack of uniformity in interpretation of disc pathology may lead to incorrect diagnoses and treatment decisions with the potential for medico-legal implications.

Unified approach to correct and standardised terminology of disc disease based on contemporary recommendations is crucial to ensure clear communication between medical professionals.

In this educational exhibit we illustrate standardized nomenclature of most common disc disease pathologies using diagrams and MRI images from our cohort of patients to simplify correct reporting process in clinical practice and propagate disc pathology correct nomenclature and classification in Magnetic Resonance Imaging.

Images for this section:



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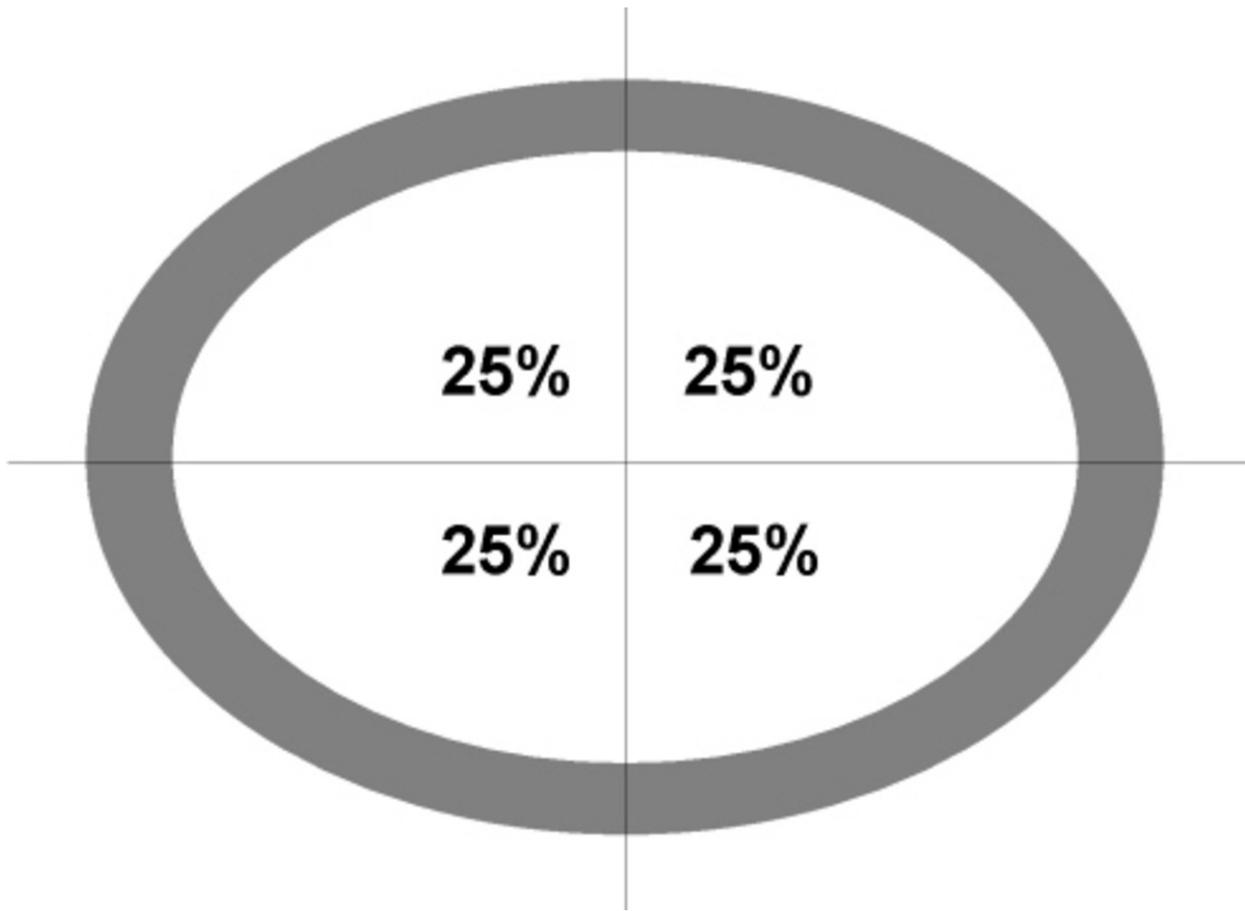


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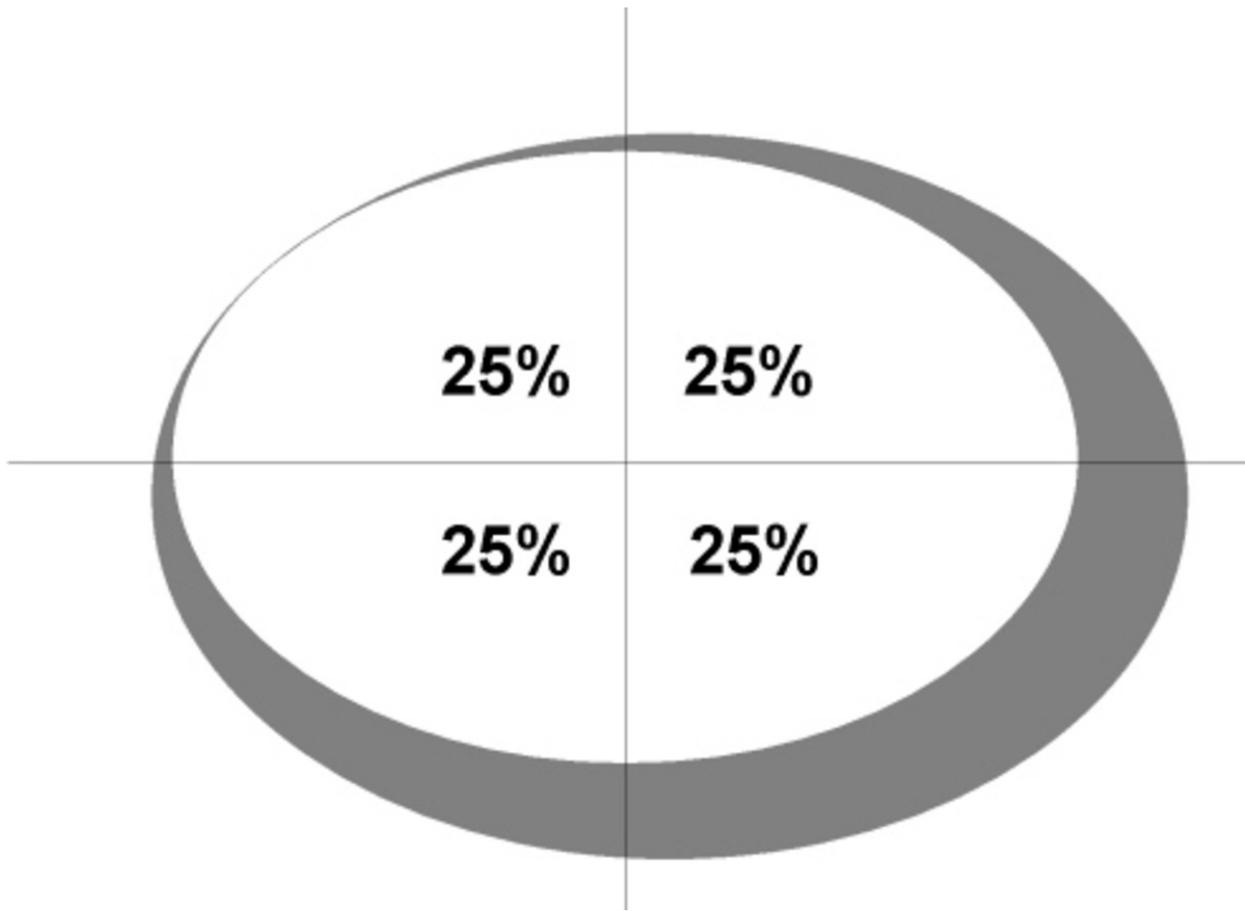


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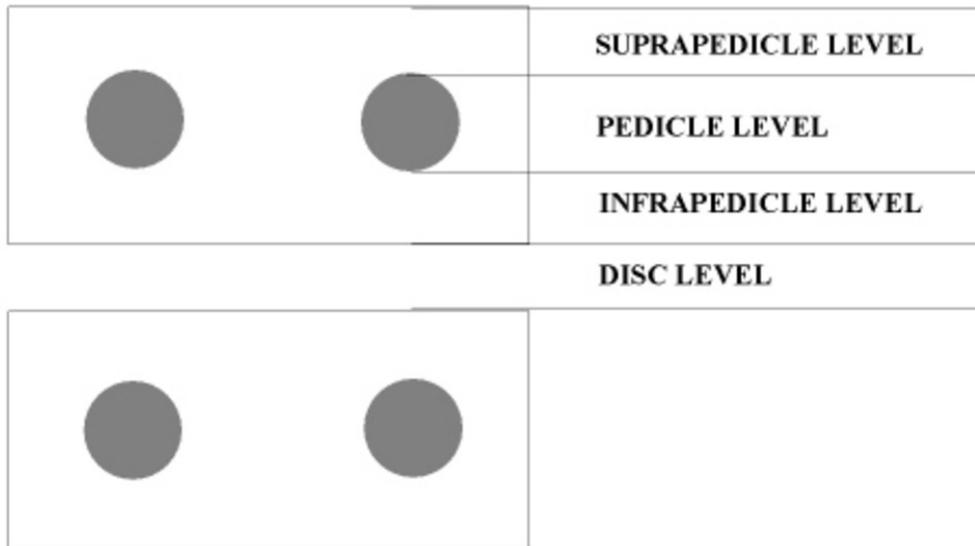


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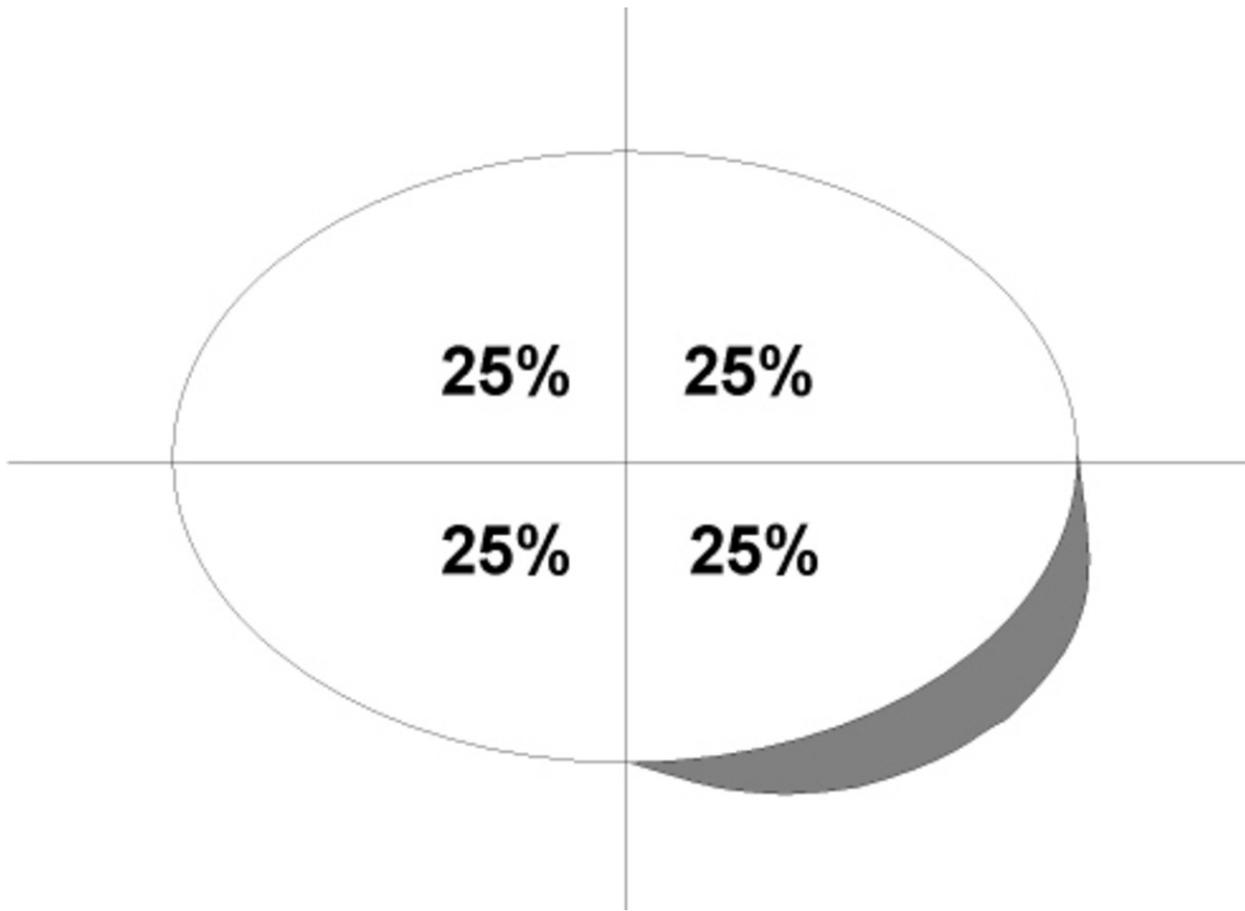


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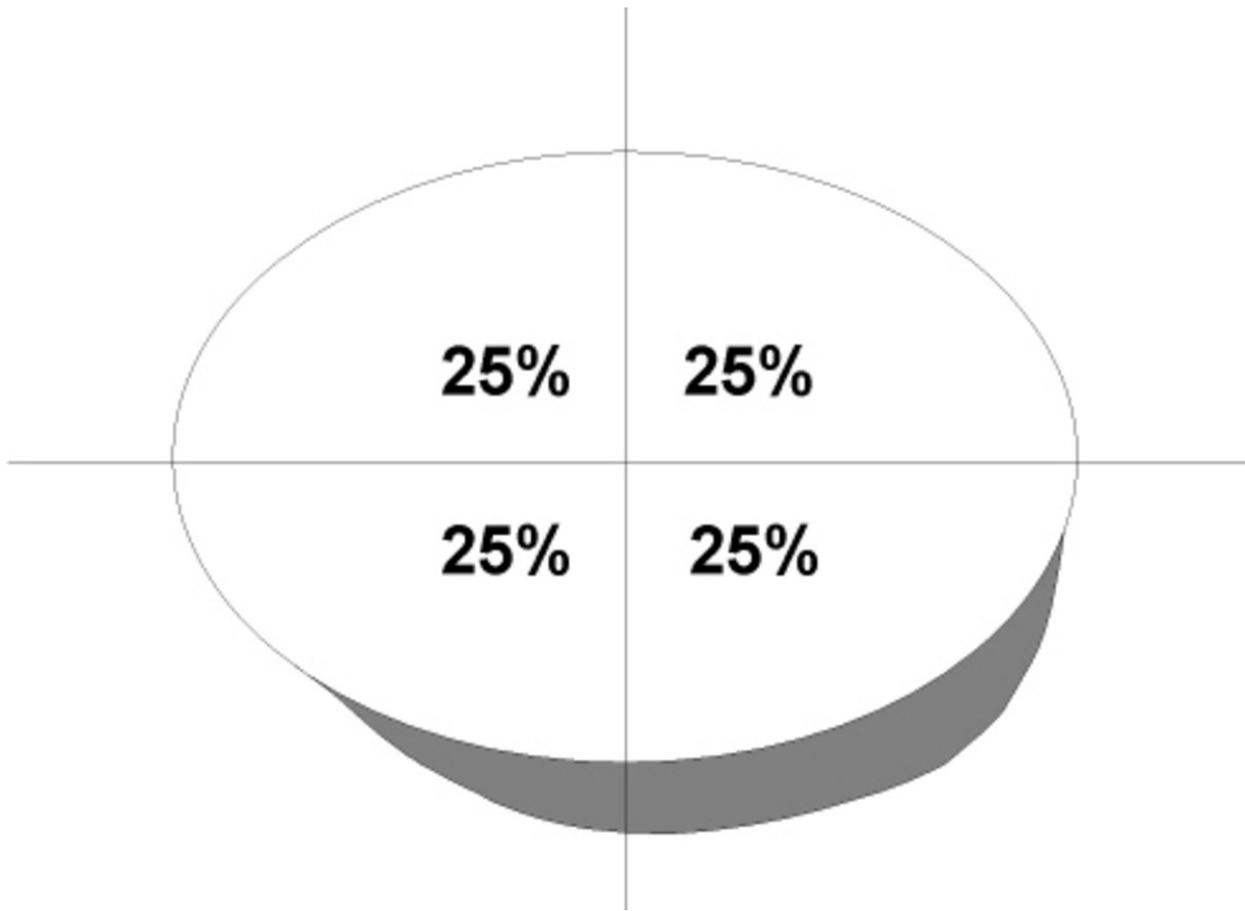


Fig. 26: Schematic Broad Based Disc Protrusion Illustration in Axial Plane

Personal information

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Images for this section:



Fig. 28: Sagittal T2 Weighted Lumbar Spine MRI image showing L5/S1 Disc Protrusion.

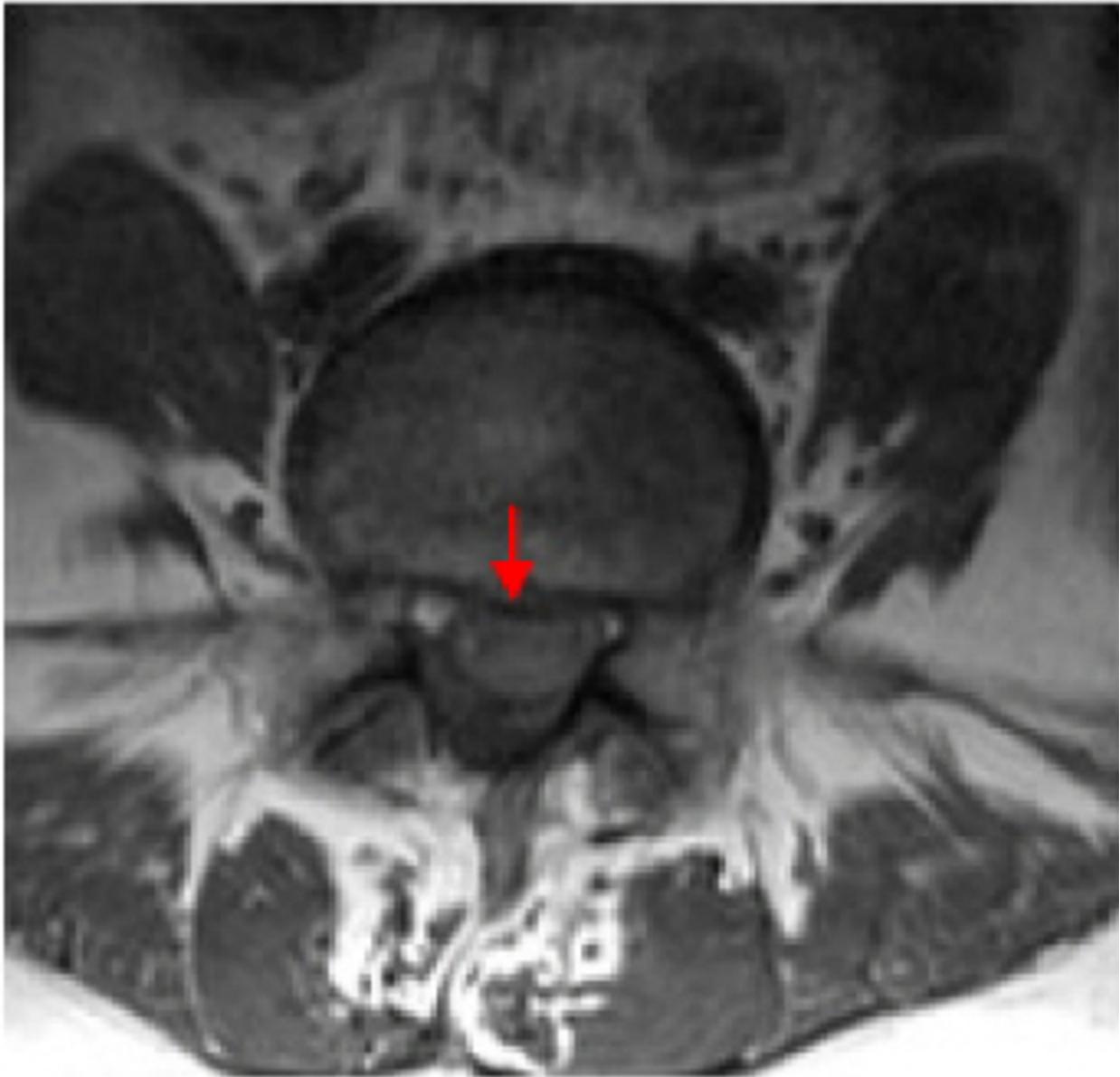


Fig. 30: Axial T1 Weighted Lumbar Spine MRI image showing L4/L5 Large Disc Extrusion with severe canal compromise.



Fig. 31: Sagittal T1 Weighted Lumbar Spine MRI. Large L4/L5 Disc Extrusion



Fig. 32: Sagittal T2 Weighted Lumbar Spine MRI image showing L4/L5 Extrusion With Inferior Migration

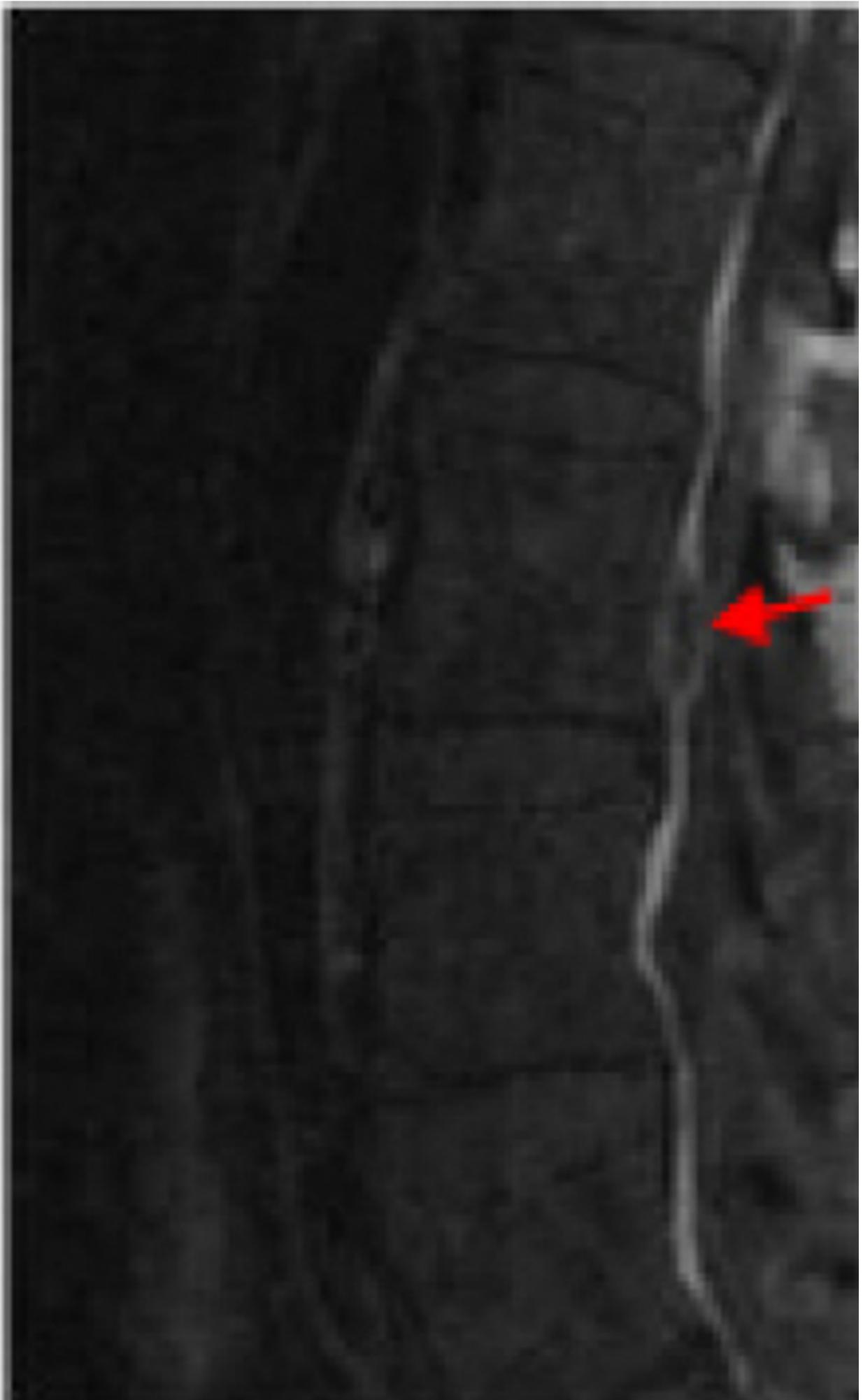


Fig. 33: Sagittal T1 Weighted Lumbar Spine MRI image showing Sequestered Disc Fragment

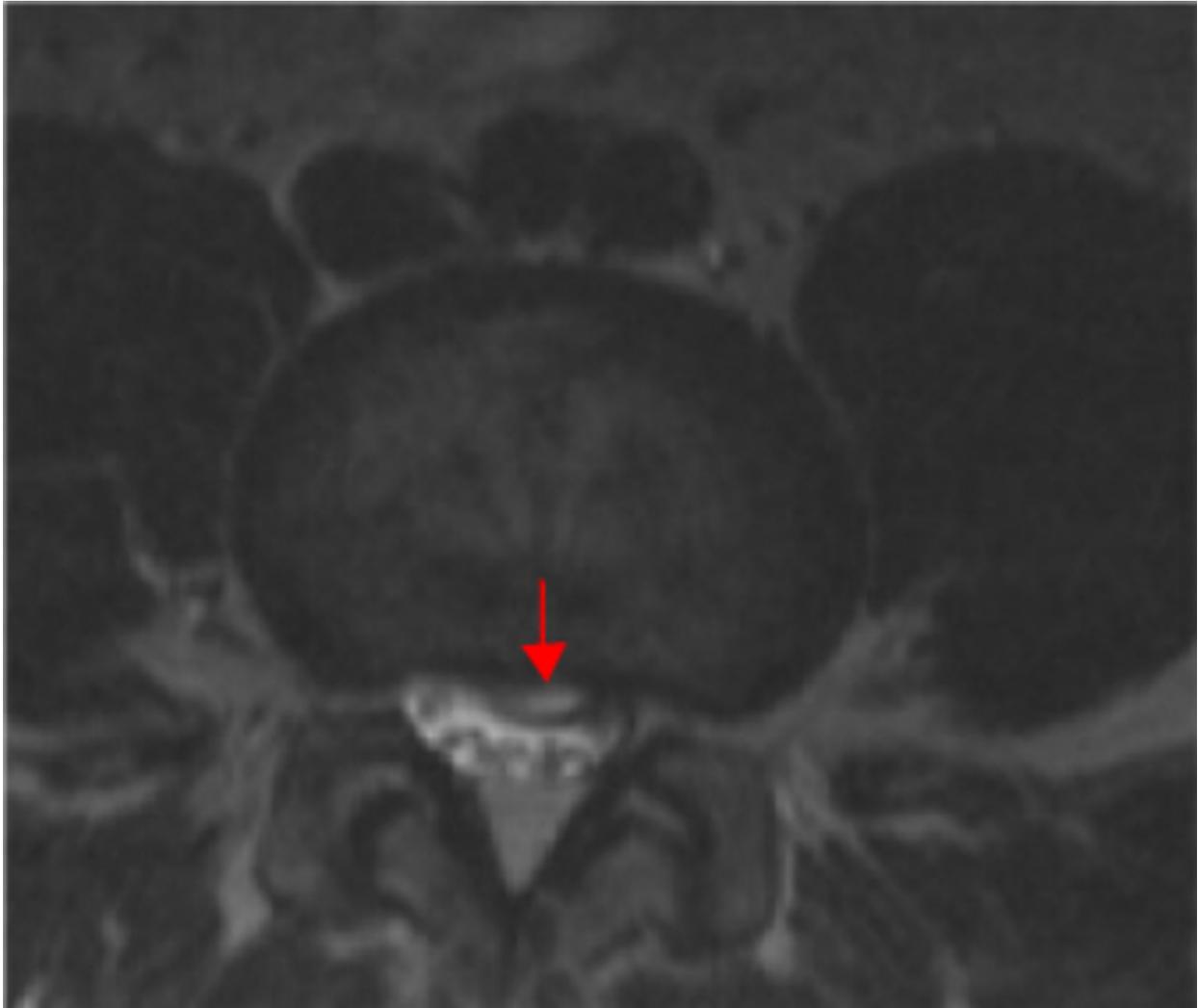


Fig. 14: Axial T2 Weighted Lumbar Spine MRI image showing Left Central Disc Herniation

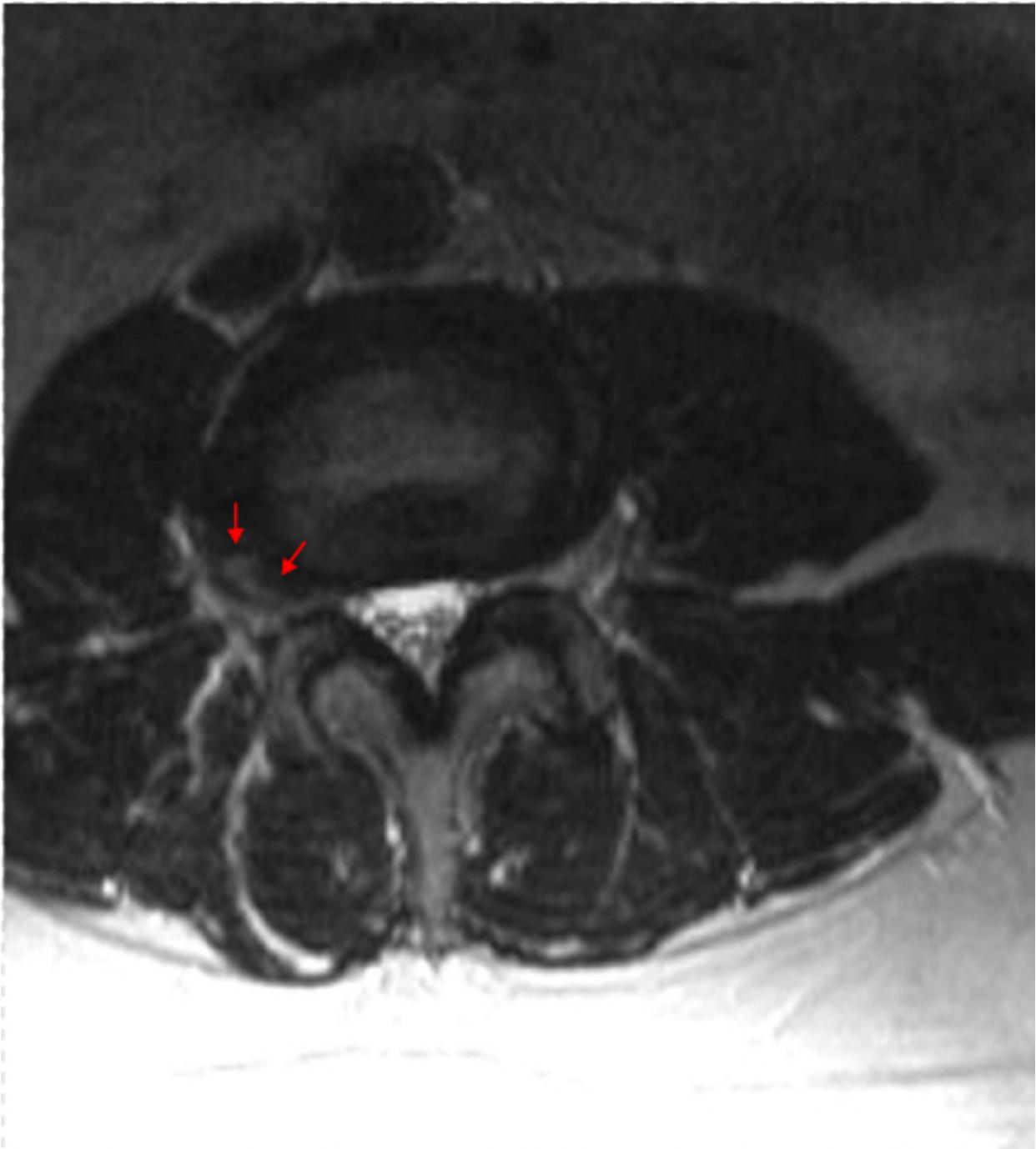


Fig. 17: Axial T2 Weighted Lumbar Spine MRI. Right Foraminal Disc Herniation



Fig. 18: Axial T2 Weighted Lumbar Spine MRI. Left Extraforaminal (far lateral) Disc Herniation

