Lee classification for Lumbar Foraminal Stenosis

Pfirrmann grading system for disc degeneration.

Schizas classification for Lumbar central spinal canal stenosis.

Lee classification for Lumbar Foraminal Stenosis

The Lee Classification for Lumbar Foraminal Stenosis is widely recognized in the evaluation of foraminal stenosis using magnetic resonance imaging (MRI). It offers a systematic approach to grading the severity of stenosis based on structural changes observed in the lumbar foramen. Here's a summary of key classifications and considerations:

Lee Classification The original Lee classification focuses on the contact between the nerve root and surrounding structures in the lumbar foramen, which can occur in four directions:

Superior contact: With the pedicle of the upper vertebra. Posterior contact: With the ligamentum flavum and facet joint. Inferior contact: Due to intervertebral disc protrusion and osteophytes. Anterior contact: With the posterior vertebral body. The classification is based on static sagittal MRI images, typically using T1-weighted sequences. It identifies nerve root compression due to foraminal narrowing from factors like disc space narrowing, facet hypertrophy, or osteophyte formation. However, its static nature doesn't capture dynamic changes during movement, such as lumbar extension.

Alternative Classifications Kunogi and Hasue Classification:

Categorizes stenosis into anteroposterior, cephalocaudal, and circumferential types but does not assign grades of severity. Wildermuth Classification:

Focuses exclusively on the degree of epidural fat obliteration seen on MRI. Varghese and Babu Classification:

A modified version of the Wildermuth system, tailored for daily radiological practice. Sartoretti Classification:

An updated version of Lee's system that incorporates high-resolution 3D T2-weighted MR images. It provides more detailed and nuanced grading of stenosis, including even minor anatomical changes. This classification considers: Foraminal stenotic ratio (FSR): The ratio of stenosis length to foramen length. Foraminal nerve angle and minimum nerve diameter. It offers improved accuracy but requires advanced imaging techniques. Foraminal Stenotic Ratio (FSR):

Proposed as a quantitative parameter for surgery indication. FSR ≥50% suggests a higher likelihood of failed conservative treatment. Clinical Use and Limitations The Lee and updated classifications are valuable tools in identifying surgical candidates for severe foraminal stenosis (e.g., Grade 3). However, they must be combined with clinical evaluations, as imaging alone may not reliably correlate with symptoms, particularly at L5-S1 levels, where dynamic factors often play a role. For patients with lumbar foraminal stenosis, clinical factors (pain severity, neurological symptoms,

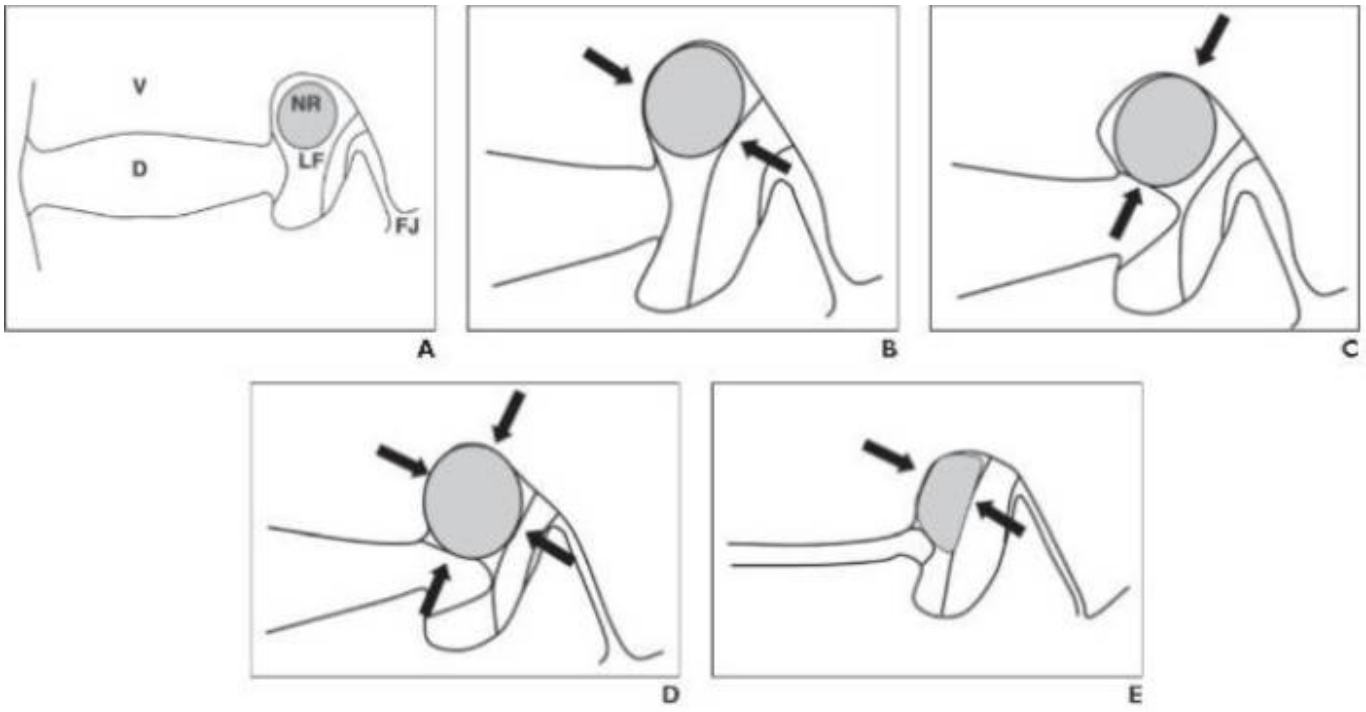
response to conservative therapy) and imaging findings should guide decision-making. The Sartoretti classification offers the most detailed anatomical insights when advanced imaging is available.

- MRI evaluation of lumbar foraminal stenosis: correlation between a new quantitative evaluation and the qualitative Lee's classification
- Inter-observer variability in the classification of lumbar foraminal stenosis in magnetic resonance imaging using different evaluation scales
- Relationship Between Lumbar Foraminal Stenosis and Multifidus Muscle Atrophy: A Retrospective Cross-Sectional Study
- Value of chemical shift imaging in the evaluation of neural foramen stenosis
- Is the presence of foraminal stenosis associated with outcome in lumbar spinal stenosis patients treated with posterior microsurgical decompression
- Is Repeated Preoperative Magnetic Resonance Imaging Necessary Before Planned Decompressive Surgery for Lumbar Spinal Stenosis?
- Predictors for second-stage posterior direct decompression after lateral lumbar interbody fusion: a review of five hundred fifty-seven patients in the past five years
- Standardized Classification of Lumbar Spine Degeneration on Magnetic Resonance Imaging Reduces Intra- and Inter-subspecialty Variability

The grading system of Wildermuth et al. and the classification proposed by Kunogi and Hasue do not consider direct nerve root compression or deformity, which may be important.

The Lee et al. system is based on the extent of fat obliteration around the exiting nerve root and the nerve root compression.

Lee et al. developed for lumbar foraminal stenosis on the basis of sagittal Lumbar spine magnetic resonance imaging four grades.



Description of the Degree of Foraminal Stenosis in sagittal MRI Based on Lee et al.'s classification.

A: Grade 0

B and C: Grade 1 (mild)

D: Grade 2 (medium)

E: Grade 3 (severe) (Lee et al., 2010).

Grade 0 refers to the absence of foraminal stenosis

Grade 1 refers to mild foraminal stenosis showing perineural fat obliteration in the two opposing directions, vertical or transverse

Grade 2 refers to moderate foraminal stenosis showing perineural fat obliteration in the four directions without morphologic change, both vertical and transverse directions

Grade 3 refers to severe foraminal stenosis showing nerve root collapse or morphologic change. A total of 576 foramina in 96 patients were analyzed (from L3-L4 to L5-S1). Two experienced radiologists independently assessed the sagittal MR images. Interobserver agreement between the two radiologists and intraobserver agreement by one reader were analyzed using kappa statistics.

According to reader 1, grade 1 foraminal stenosis was found in 33 foramina, grade 2 in six, and grade 3 in seven. According to reader 2, grade 1 foraminal stenosis was found in 32 foramina, grade 2 in six, and grade 3 in eight. Interobserver agreement in the grading of foraminal stenosis between the two readers was found to be nearly perfect (kappa value: right L3-L4, 1.0; left L3-L4, 0.905; right L4-L5, 0.929; left L4-L5, 0.942; right L5-S1, 0.919; and left L5-S1, 0.909). In intraobserver agreement by reader 1, grade 1 foraminal stenosis was found in 34 foramina, grade 2 in eight, and grade 3 in seven. Intraobserver agreement in the grading of foraminal stenosis was also found to be nearly perfect (kappa value: right L3-L4, 0.883; left L3-L4, 1.00; right L4-L5, 0.957; left L4-L5, 0.885; right L5-S1, 0.800; and left L5-S1, 0.905).

The grading system for foraminal stenosis of the lumbar spine showed nearly perfect interobserver and intraobserver agreement and would be helpful for clinical study and routine practice [1)]

1)
Lee S, Lee JW, Yeom JS, Kim KJ, Kim HJ, Chung SK, Kang HS. A practical MRI grading system for lumbar foraminal stenosis. AJR Am J Roentgenol. 2010 Apr;194(4):1095-8. doi: 10.2214/AJR.09.2772. PMID: 20308517.