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DIAGNOSTIC DILEMMAS IN POST-SURGICAL SCIATICA: A RADIOLOGICAL PERSPECTIVE

Medicine

Alomari Laith	Radiology Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan
Halasah Mu'taz	Radiology Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan
Okour Ibrahim	Radiology Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan
Qandah Rami	Medicine Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan
Abu-Rumman Khalid	Neurosurgery Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan
Al-Ali Osama	Neurosurgery Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan
Malabeh Qamar	Radiology Department, King Hussein Medical Center - Royal Medical Services, Amman-jordan

ABSTRACT

Introduction: Sciatica affects 12–43% of individuals, imposing an economic burden exceeding $50 billion annually in the United States. Lumbar discectomy, performed in ~10% of cases, offers symptom relief but yields variable outcomes and a 10–40% risk of persistent or recurrent pain, often classified as "failed back surgery syndrome" (FBSS). Postoperative imaging is crucial for assessing complications, with MRI, especially gadolinium-enhanced, being the gold standard for differentiating normal healing from pathology. **Objectives:** This study evaluates nerve root changes, disc space alterations, and epidural fibrosis in recurrent sciatica cases post-surgery, while also reviewing typical MRI appearances of healing and complications. **Methods And Patients:** This retrospective study analyzed medical records and imaging of 139 patients who underwent first-time lumbar disc surgery at King Hussein Medical Center (2021–2023). Inclusion criteria included persistent radicular pain (VAS 4–10) lasting >6 weeks postoperatively despite conservative management. MRI evaluations assessed recurrent disc herniation (RDH), epidural fibrosis (PEF), nerve root enhancement (NRE), and nerve root thickening (NRT). Imaging included pre- and post-contrast sequences on 3T scanners. Clinical and radiological findings were correlated to assess associations with symptoms. Statistical analysis included t-tests and interobserver agreement (ICC). Findings highlight the role of MRI in identifying postoperative complications and their clinical implications. **Results:** The study analyzed 139 patients (78 males, 61 females; median age: 48.62 ± 7.1 years) undergoing lumbar disc surgery across 196 levels. No significant differences were observed between sexes in age, BMI, VAS scores, follow-up duration, or smoking history. The mean symptom duration was 4.6 ± 2.82 months, with a 9.32 ± 3.12-month follow-up period. Postoperative MRI demonstrated excellent interobserver reliability (ICC ≥0.81). VAS scores for leg pain improved significantly from preoperative levels (males: 7.21 ± 2.31 to 0.95 ± 1.09; females: 6.48 ± 2.78 to 1.36 ± 1.25). Complications included disc recurrence (16.3%), epidural fibrosis (38.8%), pathological nerve root enhancement (20.8%), and nerve root thickening (58.4%), with no significant sex-based differences. The results underscore MRI's role in monitoring postoperative outcomes and complications. **Conclusion:** Postoperative nerve root alterations, including thickening, enhancement, and epidural fibrosis, combined with recurrent sciatica or disc herniation, may indicate the need for further surgical intervention, particularly in cases of failed back surgery syndrome (FBSS). Despite limitations in sample size and long-term follow-up, this study highlights the critical role of contrast-enhanced MRI as the gold standard for assessing postoperative lumbar spine changes, enabling accurate evaluation of normal healing and complications.

KEYWORDS

Postoperative imaging; Failed back surgery syndrome; Postoperative sciatica; Recurrent disc; epidural fibrosis; nerve root thickening, nerve root enhancement.

INTRODUCTION

Sciatica affects an estimated 12% to 43% of individuals over their lifetime [1,2], manifesting as radiating leg pain, sensory impairment, and motor dysfunction [1,3]. In the United States, the condition imposes a substantial economic burden, with total direct and indirect costs, including lost productivity and wages, exceeding $50 billion annually [4-6].

Conventional and microscopic lumbar discectomy is an elective surgical intervention performed in approximately 10% of patients with sciatica to alleviate symptoms and facilitate functional recovery [7-9]. While lumbar spinal surgery can provide significant benefits for certain patients, its outcomes are highly variable and challenging to predict on an individual basis [10,11]. As the invasiveness of spinal surgery increases, the risk of potential postoperative complications also rises. These complications may include neural compression caused by hematoma, recurrent disc herniation, epidural fibrosis, dural tears with pseudo-meningocele formation, and infection. Additionally, the use of spinal instrumentation introduces specific risks, such as mal-positioned hardware and failed spinal fusion, which can result in instrumentation loosening or breakage. [١٢-13]. In 10% to 40% of patients undergoing lumbar spine surgery, low back pain either persists or recurs, potentially leading to classification as "failed back surgery syndrome" (FBSS), a condition requiring specialized management. The etiology of FBSS is multifactorial and often complex, necessitating careful differentiation between normal postoperative changes and pathological findings associated with FBSS [10-12].

The choice of imaging modality for evaluating postoperative lumbar spine patients depends on the type of surgical intervention performed, the use of metallic instrumentation, and the clinical suspicion. Understanding the advantages and limitations of each imaging technique is crucial for optimal assessment, particularly in cases involving instrumentation, where minimizing artifacts caused by metallic materials is essential for accurate diagnosis [14,15]. Proper interpretation of postoperative imaging requires a thorough understanding of the surgical procedure performed, the expected postoperative course, and the normal imaging appearances of healing. Plain radiographs and computed tomography (CT) remain pivotal for evaluating spinal fusion and detecting complications related to instrumentation. However, cross-sectional imaging techniques, particularly CT and magnetic resonance imaging (MRI), offer greater sensitivity and play an increasingly significant role in the postoperative evaluation of lumbar spine surgery [14,16]. MRI is especially critical in assessing the postoperative spine, with gadolinium-enhanced images being the preferred modality for

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investigating recurrent symptoms after discectomy according to many reports [10,12,14-20]. This study steered to appraise the relationship between nerve root changes, disc space alterations, and epidural fibrosis in cases of persistent or recurrent sciatica following lumbar disc surgery. Furthermore, gadolinium-enhanced MRI aids in distinguishing normal postoperative findings from pathological complications. This study also aims to review the typical early and late MRI appearances of the healing process post-laminectomy, as well as imaging features associated with postoperative complications

MATERIALS AND METHODS

Ethics

Patient imaging and medical records from January 2021 to January 2023 were retrieved from the King Hussein Medical Center (KHMC) database and analyzed retrospectively. The study was approved by the Royal Medical Services Institutional Ethics Committee (Approval No. 48/17/2024). Given the retrospective nature of the study, the requirement for informed patient consent was waived.

Patients

We collected data from 987 consecutive adult patients who had undergone first-time surgery for one or two levels of herniated lumbar disc prior to the study period. All patients presented between January 2021 and January 2023 with new or persistent moderate-to-severe low back pain and radicular pain, as assessed by the Visual Analogue Scale (VAS) (score range: 4–10). Symptoms persisted for more than six weeks despite conservative treatments, including physical therapy and medications.

All patients underwent serial physical examinations and radiological assessments using pre- and post-contrast magnetic resonance imaging, including T1- and T2-weighted sagittal and axial views. Imaging was primarily evaluated for recurrent disc herniation and other changes at the surgical site [Figure 1]. Clinical outcomes were assessed using VAS scores for radicular and lower back pain. Additional evaluations included the type and degree of disc herniation, intervertebral disc enhancement patterns, nerve root thickening, and postoperative epidural fibrosis. Potential habitual risk factors, such as smoking status and history of traumatic events, were also analyzed for their contribution to lumbar disc herniation recurrence.

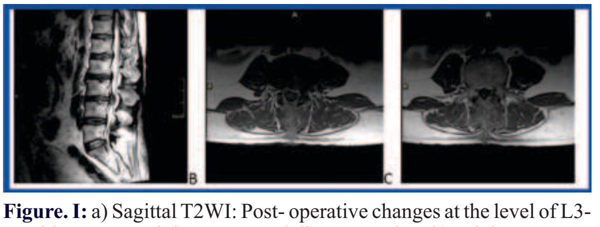

Figure. I: a) Sagittal T2WI: Post- operative changes at the level of L3-4; with recurrent right paracentral disc protrusion, b) axial T1WI post contrast shows right paracentral non-enhancing recurrent disc compressing right nerve root at the RT lateral recess, with circumferential rim of enhancing adhesions extending posteriorly, c)axial T1WI at a lower level: focal enhancement in the center of the thecal sac indicating post-operative nerve roots enhancement.

Out of the initial cohort, 139 patients met the inclusion criteria and were eligible for the final analysis. Inclusion criteria specified prior surgery for one- or two-level lumbar disc herniation, persistent moderate-to-severe lower back pain with radicular symptoms (VAS 4–10), and refractory symptoms lasting more than six weeks despite conservative management. Exclusion criteria included patients with acute neurological deficits, documented postoperative infections, spondylolisthesis, arachnoiditis, axial back pain without radiculopathy, prior spinal instrumentation, spinal tumor resections, or loss to follow-up.

Inclusion/ Exclusion Criteria

Inclusion criteria:

1) Patients who underwent surgery for one or two levels of lumbar spine disc disease.
2) Persistent radicular pain lasting more than six weeks postoperatively.
3) A minimum follow-up period of six months.
4) Failure to achieve symptom resolution with postoperative conservative management.

Exclusion Criteria Were:

1) Inadequate documentation of follow-up.
2) Cases involving oncology, spondylolisthesis, arachnoiditis, or postoperative infection.
3) The presence of severe systemic diseases, including cardiovascular conditions, thromboembolism, bleeding disorders, or renal dysfunction.
4) Age below 18 years.
5) Patients with acute neurological deficits or prior spinal instrumentation.
6) Patients presenting with axial low back pain without associated radicular symptoms.

Study Design

This study was conducted retrospectively by reviewing the medical records and radiological images of all consecutive patients evaluated at King Hussein Medical Center (KHMC). Patient medical reports were retrieved from the hospital's electronic database for comprehensive analysis.

Radiologic Evaluation Assessment

Postoperative radiological evaluations were performed using 3T MR imaging scanners (Intera; Philips Medical Systems, Best, the Netherlands). The imaging protocol included pre-contrast and post-contrast sequences with the following parameters:

1. Pre-contrast Imaging:

- Turbo spin-echo (TSE) axial T1-weighted imaging (TR: 550 ms; TE: 8.0 ms) with a slice thickness of 3 mm and an interslice gap of 0.4 mm.
- TSE sagittal T1-weighted imaging (TR: 600 ms; TE: 8.0 ms) with a slice thickness of 3 mm and an interslice gap of 0.4 mm.
- TSE axial T2-weighted imaging (TR: 2500 ms; TE: 100 ms) with a slice thickness of 3 mm and an interslice gap of 0.4 mm.
- TSE sagittal T2-weighted imaging (TR: 2154 ms; TE: 120 ms).
- Sagittal STIR sequence (TR: 3077 ms; TE: 80 ms) with a slice thickness of 3 mm and an interslice gap of 0.4 mm.

2. Post-contrast Imaging:

After intravenous administration of 0.1 mmol/kg of gadolinium-DTPA (Magnevist; Bayer Schering Pharma, Pittsburgh, PA), fat-suppressed axial and sagittal T1-weighted images were acquired with a slice thickness of 3 mm.

The imaging field of view (FOV) was set to 200 × 200 mm for axial images and 300 × 300 mm for sagittal images. The matrix resolution was 256 × 205 for axial images and 512 × 256 for sagittal images. Axial images included one or more levels above the operative site and extended to at least one level below it, except at the terminal disc level (L5-S1), where caudal slices were limited to the midpoint of the S1 vertebral body.

Evaluation Parameters

Imaging Assessments Focused On The Surgical Levels, Evaluating:

- Recurrent disc herniation.
- Epidural fibrosis.
- Nerve root enhancement and thickening.

Timelines for Contrast MRI

MRI was performed at approximately 3-month and 6-month intervals postoperatively.

Two experienced radiologists (M.Q. and A.L.), blinded to patients' clinical histories, prior imaging, and levels of radiculopathy, independently reviewed the imaging studies to ensure objective evaluation.

Recurrent Disc Herniation (RDH)

Recurrent disc herniation (RDH) was radiologically defined as a focal, low-signal-intensity mass at the operative site on T1-weighted images, without central enhancement, and contiguous with the parent disc unless sequestrated.

The degree of recurrent disc herniation was classified into protrusion, extrusion, and sequestration, according to the American Society for Neuroradiology terminology [2١-2٤]. In cases where postoperative epidural fibrosis coexisted with recurrent disc herniation, the patient was categorized into the RDH group [Figure ٢].

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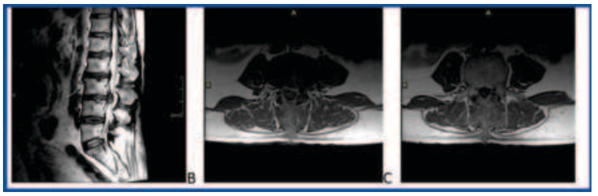

Figure. II: a) sagittal T2WI: Post- operative changes at the level of L3-4; with recurrent right paracentral disc protrusion, b) axial T1WI post contrast shows right paracentral non-enhancing recurrent disc compressing right nerve root at the RT lateral recess, with circumferential rim of enhancing adhesions extending posteriorly, c)axial T1WI at a lower level: focal enhancement in the center of the thecal sac indicating post-operative nerve roots enhancement.

Postoperative Epidural Fibrosis (PEF)

Epidural fibrosis was defined radiologically by iso- to hypo-intensity on T1-weighted MRI scans, where it replaced the normal epidural fat intensity [Figure ٣]. Epidural fibrosis typically appeared homogeneous. The degree of peridural scarring was graded on a scale of 0 to 4 at each level, based on the method described by Ross et al. [21–2٧]. In this grading system, a score of 0 indicates no scarring, 1 indicates 0% to 25% scar fill in one quadrant, 2 indicates 25% to 50%, 3 indicates 50% to 75%, and 4 indicates 75% to 100% scar fill.

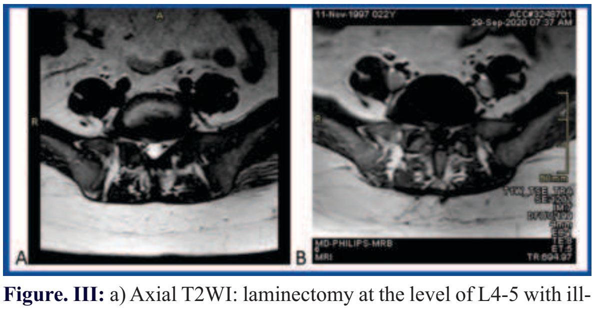

Figure. III: a) Axial T2WI: laminectomy at the level of L4-5 with ill-defined intermediate signal lesion in the RT anterior epidural space compressing the RT enlarged hyperintense L5 traversing nerve root, b) Axial T1WI post-contrast shows the lesion exhibits intermediate homogenous enhancement suggesting postoperative fibrosis encasing the right aspect of the thecal sac and compressing the right traversing nerve root. No evidence of recurrent disc.

The relationship between nerve root changes, peridural fibrosis (PEF), and clinical symptoms was also assessed. Both epidural fibrosis and disc protrusions can exert a mass effect, especially in the early stages of tissue granulation. As epidural fibrosis ages, the dura may retract toward the scar side. Post-contrast, epidural fibrosis demonstrates immediate enhancement, in contrast to recurrent disc herniation, which typically shows a delayed enhancement (up to 20 minutes) after contrast injection [2٦].

Measurement of Nerve Root Enhancement (NRE)

Nerve root enhancement (NRE) was assessed using two approaches:

1. **Comparison of Pre- and Post-contrast Axial T1-weighted Images:** Evaluating enhancement by visualizing differences in nerve root appearance before and after contrast administration.
2. **Comparison with the Contralateral Nerve Root:** Assessing the enhanced nerve root relative to its equivalent on the opposite side [Figure 4].

NRE was classified as either present or absent. The same method was applied for evaluating the contralateral nerve root on post-contrast images.

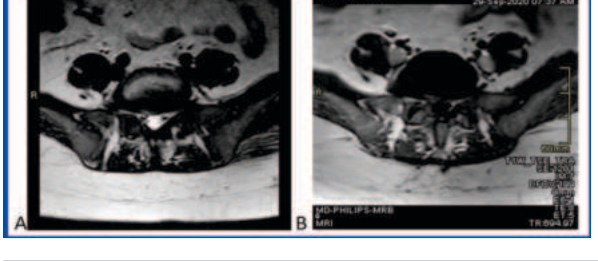

Figure. IV: a) Axial T2WI: laminectomy at the level of L4-5 with ill-defined intermediate signal lesion in the RT anterior epidural space compressing the RT enlarged hyperintense L5 traversing nerve root, b) Axial T1WI post-contrast shows the lesion exhibits intermediate homogenous enhancement suggesting postoperative fibrosis encasing the right aspect of the thecal sac and compressing the right traversing nerve root. No evidence of recurrent disc.

Nerve Root Thickening (NRT)

Increase of a more than 50% in diameter of a nerve root compared with the contralateral nerve root at the same level was defined as Thickening. To avoid misreading due to adjacent scar tissues, nerve root thickening was assessed only on postcontrast images. Thickening of nerve roots was also correlated with clinical signs [Figure 5].

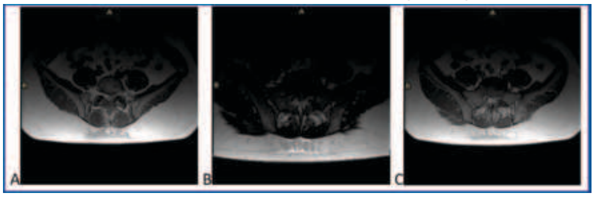

Figure V: a) Axial T1WI post-contrast at the level of L5-S1 shows minimal left anterior epidural enhancing adhesions compressing left S1 nerve root. b & c) Axial T2WI and axial T1WI post-contrast demonstrate mild thickening with central T2 hyperintensity along with focal heterogenous enhancement of the left epidural S1 nerve root.

Images Assessment

Visual evaluations were independently performed by two experienced radiologists with over eight years of expertise. In cases of disagreement between observers, pixel intensity measurements were conducted to provide an objective assessment.

Correlation With Clinical Presentation

The presence of NRE was correlated with the patient's clinical presentation. Medical records were reviewed to identify:

- Distribution of radiculopathy.
- Dermatomal deficits.
- Loss of muscle reflexes.

In some cases, supplementary electromyographic (EMG) studies were performed, and their results were incorporated to determine the affected nerve root level.

Determining The Association

The association between NRE and clinical symptoms was established by matching the site of NRE identified on imaging to the level of radiculopathy implied from neurological signs and/or EMG findings. This process ensured that imaging findings were directly linked to the patient's symptomatic presentation.

Demographic data, including sex, age, symptom duration, medical history, and social history, were collected for all patients. All surgical procedures were performed by a single neurosurgeon (A.O.) using a standardized technique. While the operating surgeon was fully informed of each patient's prior and current medical history, the assistant neurosurgeons responsible for follow-up evaluations and data analysis were blinded to the patient groups to minimize bias.

Statistical Analysis

For statistical analysis, patient data was recorded and managed using Microsoft Excel 2010, and relevant information was analyzed with SPSS version 23.0. Continuous variables are presented as median (range) or mean ± standard deviation. The intraclass correlation coefficient (ICC) was calculated to assess interobserver agreement between the two neuroradiologists for MRI observations. To evaluate clinical outcomes over time, an unpaired sample t-test was performed in Excel 2010 to compare preoperative data with outcomes at 3 months and 6 months postoperatively. Additionally, an unpaired Student's t-test was used to compare outcomes between groups. A p-value of <0.05 was considered statistically significant.

The final study population consisted of 78 males and 61 females, encompassing a total of 196 operated disc levels, with a male-to-female ratio of 1.28:1. The age distribution ranged from 25 to 61 years, with a median age of 48.62 ± 7.1 years. Statistical analysis revealed no significant differences between the male and female groups regarding mean age, operated levels, body mass index (BMI), preoperative VAS scores for back pain and leg pain, mean follow-up duration, or smoking history (Table 1). Additionally, preoperative VAS scores were comparable between male and female patients. Clinically, the mean symptom duration prior to surgery was 4.6 ± 2.82 months, and the average postoperative follow-up period was 9.32 ± 3.12 months. Early postoperative complications, such as seroma, hematoma, or surgical site infections occurring within the first few days after surgery, were excluded from this article. Interobserver reliability for MRI parameter measurements between the two radiologists was generally excellent, with intraclass correlation coefficients (ICCs) ≥0.81. No surgery-related mortality was reported.

Table 1: Patient demographic data and characteristics.

Parameter	Males	females	p value
Number of patients	78	61	0.224
Levels (1 level/ 2 levels)	120 (66/54	76 (44/32)	0.663
Average Age (years)	47.12±4.6	50.33±6.31	0.07
BMI*	28.1±3.2	27.2±3.6	0.98
Preoperative VAS(back pain)	6.48±2.77	6.24±2.84	0.66
Preoperative VAS(Leg pain)	7.21± 2.31	6.48±2.78	0.36
Mean follow up duration (months)	9.22±2.68	7.34±3.6	0.225
History of smoking	31	20	0.95
History of trauma	11	9	0.44
*BMI = body mass index			

Table II: The average visual analogue scale (VAS) of leg pain

	Pre-operative	3-months	6-months
Average VAS males	7.21± 2.31	1.63 ± 1.21	0.95 ± 1.09
Average VAS females	6.48±2.78	2.18 ± 1.25	1.36 ± 1.25
p value	0.66	0.33	0.226

Table III: The complications encountered during the study period

Complication	Female Patients (n)	Male Patients(n)	Overall %	P value
Disc recurrence	15	16	16.29%	NS
Epidural Fibrosis	30	41	38.76%	NS
Pathological NRE	19	20	20.78%	NS
NRT	56	49	58.43%	NS
NS~ non-significant				

DISCUSSION

Conventional and microscopic lumbar spine surgeries are increasingly common, offering a wide range of surgical options [13,14]. However, up to 40% of postoperative cases present with persistent back or leg pain, often characterized as mixed pain. This pain frequently includes elements of preexisting chronic pain that were previously managed with conventional analgesics or narcotics. Long-term use of these medications may alter pain perception, complicating postoperative pain management [14,27-29].

Proper interpretation of postoperative radiological findings requires distinguishing normal changes induced by soft tissue disruption and direct nerve root manipulation from potential complications. Postoperative complications occur in approximately 15–30% of cases [30] and may arise acutely or manifest later, leading to symptom persistence or exacerbation. Differentiating these complications from failed back surgery syndrome is critical.

An essential step in postoperative radiological evaluation is to consider the time elapsed since surgery, the primary cause for surgery, the surgical technique used, and the patient's current clinical presentation. These factors guide the choice of imaging modality, and the specific protocols required for an accurate radiological assessment [31].

Normal Radiological Findings In Postoperative Course

At our center, the open microscopic inter-laminar approach is the most frequently employed surgical technique for managing lumbar disc herniation. This involves laminectomy and discectomy, with partial removal of the herniated material and/or native disc [13]. Common radiological findings during the early postoperative period (up to 8 weeks) include asymmetrical presentation of muscles and fat, edematous subcutaneous tissue, and small seromas. These findings generally resolve progressively within the first two months. However, during this period, they may exert a mild posterior mass effect on the thecal sac [13,14,32].

MRI is performed within the first 8 weeks postoperatively only if the patient develops moderate to severe low back pain. Post-contrast imaging typically reveals homogeneous enhancement, indicative of healing processes such as granulation tissue formation, which helps mitigate any detected mass effect [Figure 6]. Additionally, vertebral endplates may demonstrate edematous changes and enhancement, which have been observed in approximately 19% of patients between 6 and 18 months postoperatively [33–36]. In our study, 123 patients exhibited postoperative clinical symptoms, and imaging revealed a range of abnormal radiological findings across the 196 operated disc levels (Table 2).

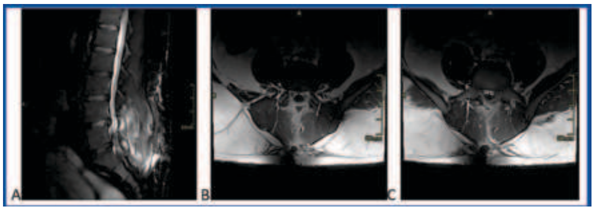

Figure. IV: a) Sagittal STAIR demonstrates postoperative changes at the level of L4-5 ,Small hyperintense lesion at the site of the laminectomy indicates localized collection, b) Axial T1WI post contrast shows circumferential enhancing tissue surrounding the thecal sac representing post- operative scar (epidural fibrosis).There is focal enhancement of the thickened left epidural L5 nerve root. Two peripherally enhanced localized collections at the site of laminectomy not causing mass effect upon the thecal sac, c) Axial T1WI post contrast at a lower level, there is a faint enhancement in the S1,S2 traversing nerve roots within the thecal sac.

Abnormal Radiological Findings In Postoperative Lumbar Spine

Recurrent Disc Herniations

Recurrent disc herniations have been reported in 3–20% of cases following lumbar discectomy in various reviews [13,15,25,37–41]. Clinically, they are defined as a recurrence of symptoms after a pain-free period of at least six months postoperatively. Magnetic resonance imaging (MRI) with contrast is considered the diagnostic modality of choice due to its superior contrast resolution [Figure VII]. Contrast infusion is pivotal in differentiating recurrent disc herniations from epidural fibrosis. Disc herniations typically show early central non-enhancement with peripheral enhancement caused by granulation tissue or dilated epidural venous plexus. In contrast, epidural fibrosis demonstrates diffuse enhancement [23–26].

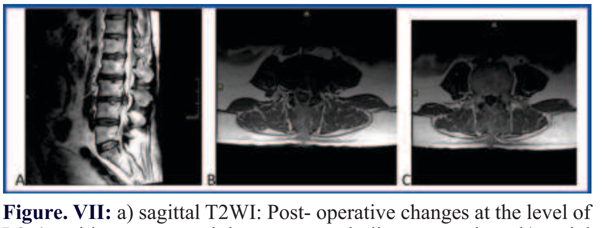

Figure. VII: a) sagittal T2WI: Post- operative changes at the level of L3-4; with recurrent right paracentral disc protrusion, b) axial T1WIpost contrast shows right paracentral non-enhancing recurrent disc compressing right nerve root at the RT lateral recess, with circumferential rim of enhancing adhesions extending posteriorly, c) axial T1WI at a lower level: focal enhancement in the center of the thecal sac indicating post-operative nerve roots enhancement.

Our findings aligned with the existing literature. In this study, the recurrence rate among symptomatic cases admitted was 16.29%, while it accounted for 4.68% of all patients who underwent surgery during the study period. There was no significant gender predominance in recurrence rates.

Nerve Roots Enhancement

Nerve root enhancement has been documented in 20–62% of patients in the literature [42–45]. While NRE within 3–6 weeks postoperatively is generally classified as a normal finding and tends to resolve gradually, any enhancement observed beyond six weeks is considered pathological.

In this study, NRE was identified in 20.78% of the population. Its presence was closely associated with clinical symptoms, including the distribution of typical radicular pain, the presence of dermatomal deficits, and loss of muscle reflexes. This correlation underscores the importance of NRE as a radiological marker linked to postoperative clinical presentations.

Nerve Roots Thickening

Nerve root thickening (NRT) has traditionally been considered to have limited standalone diagnostic value [18,43,44]. However, when combined with nerve root enhancement (NRE), NRT demonstrates a stronger association with recurrent clinical symptoms, particularly in cases involving recurrent disc herniation (RDH) [17,42].

In this review, NRT was observed in 58.43% of the disc levels screened. Among these, 67-disc levels showed a significant correlation with clinical symptoms ($P < 0.001$). Of the levels with NRT, only 23 were associated with pathological NRE, while 50 levels demonstrated pathologic epidural fibrosis features. These findings underline the diagnostic significance of NRT when evaluated in conjunction with other pathological markers, particularly in cases of persistent or recurrent symptoms.

Postoperative Epidural Fibrosis

Postoperative epidural fibrosis, though a physiological response to surgical intervention, refers to the abnormal formation of scar tissue in the epidural space. The processes underlying the development of postoperative epidural adhesions remain unclear. Epidural fibrosis has been reported in 24–38% of patients with failed back surgery syndrome [45-47]. In our analysis, postoperative scarring was observed in 38.76% of all disc levels scanned. While isolated postoperative epidural fibrosis had minimal clinical impact, the combination of this fibrosis with other pathological findings was associated with more severe clinical symptoms.

A limited number of studies have explored nerve root markers on postoperative MR imaging, their relationships to clinical outcomes, and their prognostic value, with results remaining inconclusive [10,16-18,43-49]. In the present study, we investigated the association between nerve root changes, disc space alterations, and epidural fibrosis formation in relation to postoperative clinical presentations, such as residual or recurrent sciatica following lumbar disc surgery, utilizing contrast-enhanced MR imaging [Figure VIII]. Unlike prior studies, which predominantly employed low-field-strength MRI, our analysis was conducted using a 3T MRI unit, offering higher-resolution imaging and improved diagnostic accuracy.

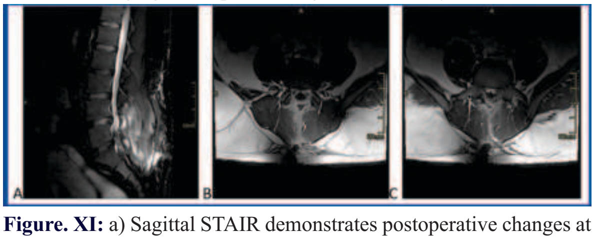

Figure. XI: a) Sagittal STAIR demonstrates postoperative changes at the level of L4-5, Small hyperintense lesion at the site of the laminectomy indicates localized collection, b) Axial T1WI post contrast shows circumferential enhancing tissue surrounding the thecal sac representing post- operative epidural fibrosis. There is focal enhancement of the thickened left epidural L5 nerve root. Two peripherally enhanced localized collections at the site of laminectomy do not cause mass effect upon the thecal sac, c) Axial T1WI post contrast at a lower level, there is a faint enhancement in the S1,S2 traversing nerve roots within the thecal sac.

However, this study has several limitations. First, it lacks a comparison of preoperative and postoperative imaging findings and does not include asymptomatic patients as controls. Second, not all patients underwent electromyography (EMG) for nerve root correlation. Additionally, the relatively small sample size and the short follow-up period may restrict the generalizability of the findings and limit insights into long-term outcomes. Socioeconomic variables that could potentially influence study results were also not accounted for in this analysis. Despite these limitations, this study provides valuable insights into postoperative imaging markers and their clinical significance using advanced imaging techniques.

CONCLUSION

The clinical significance of postoperative nerve root alterations continues to be a topic of ongoing debate. The presence of the clinical triad—nerve root thickening, enhancement, and epidural fibrosis—along with recurrent sciatica and disc herniation in postoperative patients, may indicate the need for further surgical intervention, particularly in cases of failed back surgery syndrome (FBSS). However, this study is limited by its relatively small sample size and the absence of long-term follow-up on postoperative changes. Radiological assessment of the postoperative lumbar spine is a standard procedure in radiology departments. A thorough understanding of the different surgical techniques, instrumentation used, normal postoperative changes, and potential complications is essential for providing an accurate and conclusive evaluation. Current evidence endorses contrast-enhanced MRI as the gold standard for imaging in postoperative lumbar spine assessments.

Future Work: We need a prospective standardized interval evaluations MR imaging and a larger population.

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Conflicts Of Interest: The author certify that he has no affiliation with or any direct or indirect involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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