International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 15; Issue: 5; May 2025
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Impact of Stenosis and Neural Foraminal Compromise on Low Back Pain and Postural Alignment

Anupama Dhuria[1], Dr Shallabh Kumar Singh[2], Poonam Pachauria[3]

[1]Department of Physiotherapy, Era University, Lucknow, India.

Corresponding Author: Dr. Shallabh Kumar Singh

DOI: https://doi.org/10.52403/ijhsr.20250507

ABSTRACT

Low back pain (LBP) is a common and debilitating condition often associated with lumbar spinal stenosis and neural foraminal compromise. These spinal pathologies can lead to significant pain, disability, and alterations in postural alignment. This study aims to elucidate the impact of stenosis and neural foraminal compromise on LBP and postural alignment. A cross-sectional observational study was conducted involving 80 participants, divided into two groups: 40 with lumbar spinal stenosis and/or neural foraminal compromise (Group 1) and 40 controls without these conditions (Group 2). Inclusion criteria for Group 1 included participants aged 30-70 years with a clinical and radiological diagnosis of stenosis or foraminal compromise, and LBP for at least 3 months. Exclusion criteria included history of spinal surgery, significant comorbidities, and neurological disorders. Data collection involved demographic information, MRI/CT imaging, postural assessments, VAS for pain, ODI for disability, and SF-36 for quality of life. Statistical analyses included independent t-tests and chi-square tests. Participants with stenosis or foraminal compromise reported significantly higher VAS scores (6.8 ± 1.2) compared to controls (2.1 ± 1.1), and greater ODI scores (34.5 ± 9.6 vs. 10.2 ± 5.4). Quality of life was lower in Group 1, with SF-36 physical and mental component scores significantly reduced. Postural measurements showed a lower lumbar lordosis angle (32.1° ± 8.3° vs. 43.5° ± 7.9°) and higher pelvic tilt (19.4° ± 4.5° vs. 12.7° ± 3.8°) in Group 1. Lumbar spinal stenosis and neural foraminal compromise are associated with increased LBP, greater disability, poorer quality of life, and significant postural misalignments. Comprehensive management strategies are essential for improving patient outcomes.

Keywords: Low back pain, lumbar spinal stenosis, neural foraminal compromise, postural alignment, disability, quality of life.

INTRODUCTION

Low back pain (LBP) is a prevalent musculoskeletal condition affecting a significant portion of the global population, contributing to substantial disability and economic burden. Among the various etiologies of LBP, lumbar spinal stenosis and neural foraminal compromise are particularly noteworthy. Lumbar spinal stenosis, characterized by the narrowing of the spinal canal, can lead to compression of the spinal cord or nerve roots, resulting in pain, numbness, and muscle weakness (Katz & Harris, 2008). Neural foraminal

compromise, often resulting from degenerative changes such as osteophyte formation, disc herniation, or ligamentous thickening, similarly exerts pressure on nerve roots as they exit the spinal column, exacerbating LBP symptoms (Lee et al., 2010).

The relationship between these spinal pathologies and postural alignment is complex and multifaceted. Postural alignment, defined as the arrangement of the body segments in a state of balance, is crucial for efficient movement and load distribution across the spine and lower extremities (Kendall et al., 2005). Deviations in postural alignment, such as increased lumbar lordosis or reduced pelvic tilt, may arise as compensatory mechanisms in response to pain and functional limitations imposed by spinal stenosis and foraminal compromise (Schwab et al., 2009). These compensatory postures, while initially beneficial in reducing pain or avoiding nerve compression, can over time lead to maladaptive changes and further exacerbate the underlying pathology, creating a vicious cycle of pain and postural dysfunction (Negrini et al., 2013).

Given the intricate interplay between spinal pathologies, pain perception, and postural mechanics, it is imperative to understand how stenosis and neural foraminal compromise influence LBP and postural alignment. This understanding is crucial for developing targeted therapeutic interventions aimed at alleviating pain, improving functional outcomes, and restoring optimal postural alignment. This study aims to elucidate the impact of stenosis and neural foraminal compromise on LBP and postural alignment, providing insights into the pathophysiological mechanisms underlying these conditions and informing clinical practice.

MATERIALS & METHODS

This cross-sectional observational study was conducted to evaluate the impact of stenosis and neural foraminal compromise on low back pain (LBP) and postural alignment. The study took place in a clinical setting, with data collection involving physical examinations, imaging studies, and patient-reported outcome measures. All participants provided written informed consent prior to participation.

A total of 80 participants were recruited and divided into two groups: one group with lumbar spinal stenosis and/or neural foraminal compromise (Group 1), and a control group without these conditions (Group 2).

Inclusion Criteria (Group 1: Stenosis/Foraminal Compromise)

- Age: 30-70 years
- Diagnosed with lumbar spinal stenosis and/or neural foraminal compromise (confirmed by MRI or CT scan)
- Presenting with LBP for at least 3 months
- Generally good health with no interfering conditions
- Ability and willingness to provide informed consent and comply with study procedures

Inclusion Criteria (Control Group)

- Age: 30-70 years
- No history of lumbar spinal stenosis, neural foraminal compromise, or other significant spinal pathology (confirmed by medical history and imaging)
- No current LBP or history of chronic LBP within the past year
- Generally good health with no interfering conditions
- Ability and willingness to provide informed consent and comply with study procedures

Exclusion Criteria

- History of any lumbar spine surgery
- Presence of significant spinal conditions (tumors, infections, fractures, congenital deformities)
- Known neurological conditions affecting the spine or lower limbs (e.g.,

multiple sclerosis, peripheral neuropathy)
- Severe comorbid conditions (uncontrolled diabetes, significant cardiovascular diseases, severe renal or hepatic disorders, severe psychiatric conditions)
- Pregnancy
- Current use of medications affecting the musculoskeletal system or pain perception (e.g., high-dose corticosteroids, opioids)
- Inability to comply with study procedures (due to cognitive impairment, language barriers, logistical issues)
- Recent acute injuries to the back or lower extremities

Data collection:

1. **Demographic and Clinical Data**: Age, sex, body mass index (BMI), duration and severity of LBP, and relevant medical history were recorded.
2. **Imaging Studies**: MRI or CT scans were used to assess the degree of spinal stenosis and neural foraminal compromise.
3. **Postural Assessment**: Postural alignment was evaluated using standardized tools such as the plumb line test, digital posture analysis, and spinal inclination angle measurement.
4. **Pain and Function**: The intensity of LBP was measured using the Visual Analog Scale (VAS), and functional status was assessed using the Oswestry Disability Index (ODI).
5. **Quality of Life**: The Short Form-36 (SF-36) questionnaire was used to assess overall quality of life.

STATISTICAL ANALYSIS

Descriptive statistics summarized demographic and clinical characteristics of the participants. Comparative analyses between the two groups were performed using independent t-tests for continuous variables and chi-square tests for categorical variables.

RESULT

Participant Demographics

The study included 80 participants, with 40 in the stenosis/foraminal compromise group (Group 1) and 40 in the control group (Group 2). The demographic characteristics of the participants are summarized in Table 1.

Table 1: demographic characteristics of participants

Characteristic	Group 1 (n=40)	Group 2 (n=40)	p-value
Age (years, mean ± SD)	55.3 ± 8.2	54.8 ± 7.9	0.756
Sex (M/F)	22/18	20/20	0.648
BMI (mean ± SD)	27.5 ± 3.4	26.9 ± 3.1	0.451

Clinical and Postural Measures

The clinical and postural measures of the participants are presented in Table 2

Table 2: clinical and postural measures

Measure	Group 1 (n=40)	Group 2 (n=40)	p-value
VAS for LBP (mean ± SD)	6.8 ± 1.2	2.1 ± 1.1	<0.001*
ODI Score (mean ± SD)	34.5 ± 9.6	10.2 ± 5.4	<0.001*
SF-36 Physical Component Score	38.3 ± 7.2	50.6 ± 6.8	<0.001*
SF-36 Mental Component Score	42.7 ± 8.4	48.9 ± 7.5	0.002*
Lumbar Lordosis Angle (°)	32.1 ± 8.3	43.5 ± 7.9	<0.001*
Pelvic Tilt (°)	19.4 ± 4.5	12.7 ± 3.8	<0.001*

***p < 0.05 indicates statistical significance**

The study included 80 participants, with an equal distribution in the stenosis/foraminal compromise group and the control group. The demographic characteristics (age, sex,

and BMI) were comparable between the groups, with no significant differences observed ($p > 0.05$).

Significant differences were found between the groups in clinical and postural measures. The mean Visual Analog Scale (VAS) score for LBP was significantly higher in Group 1 (6.8 ± 1.2) compared to Group 2 (2.1 ± 1.1), with a p-value of <0.001. Similarly, the Oswestry Disability Index (ODI) score was significantly higher in Group 1 (34.5 ± 9.6) compared to Group 2 (10.2 ± 5.4), with a p-value of <0.001.

Quality of life, as measured by the SF-36 physical component score, was significantly lower in Group 1 (38.3 ± 7.2) compared to Group 2 (50.6 ± 6.8), with a p-value of <0.001. The mental component score of SF-36 also showed a significant difference, with Group 1 scoring 42.7 ± 8.4 and Group 2 scoring 48.9 ± 7.5 ($p = 0.002$).

Postural alignment measures indicated significant differences between the groups. The lumbar lordosis angle was significantly lower in Group 1 (32.1 ± 8.3 degrees) compared to Group 2 (43.5 ± 7.9 degrees), with a p-value of <0.001. Additionally, pelvic tilt was significantly higher in Group 1 (19.4 ± 4.5 degrees) compared to Group 2 (12.7 ± 3.8 degrees), with a p-value of <0.001.

These results suggest that lumbar spinal stenosis and neural foraminal compromise are associated with increased LBP, greater disability, poorer quality of life, and significant alterations in postural alignment.

DISCUSSION

The results of this study highlight the significant impact of lumbar spinal stenosis and neural foraminal compromise on low back pain (LBP) and postural alignment. The findings are consistent with previous literature indicating that these conditions are major contributors to LBP and associated functional limitations (Katz & Harris, 2008; Lee et al., 2010).

Participants with stenosis or foraminal compromise reported significantly higher levels of pain, as indicated by the VAS scores, and greater disability, as measured by the ODI scores. These findings underscore the chronic nature of LBP in these patients, likely due to nerve root compression and subsequent inflammation and pain signaling (Genevay & Atlas, 2010). The control group, with no history of spinal pathology, exhibited significantly lower pain and disability levels, further emphasizing the debilitating effect of these conditions.

Quality of life, particularly the physical component, was markedly reduced in participants with stenosis or foraminal compromise. The SF-36 scores revealed significant differences between the groups, indicating that chronic LBP severely impacts physical functioning and overall well-being (Brinjikji et al., 2015). Although the mental component scores also differed significantly, the effect was less pronounced, suggesting that while physical health is more directly impacted, chronic pain and disability can also affect mental health over time.

Postural alignment measurements demonstrated significant deviations in participants with stenosis or foraminal compromise. A lower lumbar lordosis angle and increased pelvic tilt were observed, suggesting compensatory postural adaptations to alleviate nerve compression and pain. These findings align with previous research indicating that spinal deformities and alignment changes are common in individuals with chronic spinal conditions (Schwab et al., 2009). Such postural adjustments, while initially protective, may lead to further musculoskeletal imbalances and exacerbate the underlying pathology, creating a vicious cycle of pain and postural dysfunction (Negrini et al., 2013).

The clinical implications of these findings are substantial. Effective management of lumbar spinal stenosis and neural foraminal compromise should not only focus on pain relief but also address postural alignment and functional restoration. Multidisciplinary approaches, including physical therapy, pharmacological interventions, and possibly

surgical options, may be necessary to achieve optimal outcomes (Lurie & Tomkins-Lane, 2016).

CONCLUSION

This study demonstrates that lumbar spinal stenosis and neural foraminal compromise significantly increase low back pain and disability, reduce quality of life, and alter postural alignment. Addressing these factors comprehensively in clinical practice is crucial for improving patient outcomes.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Brinjikji, W., Luetmer, P. H., Comstock, B., Bresnahan, B. W., Chen, L. E., Deyo, R. A, Halabi S., Turner J.A., Avins A.I., James K., Wald J.T., Kallmes D.F. & Jarvik, J. G. (2015). Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. *AJNR Am J Neuroradiol*, 36(4), 811-816.
2. Genevay, S., & Atlas, S. J. (2010). Lumbar spinal stenosis. *Best Practice & Research Clinical Rheumatology*, 24(2), 253-265.
3. Katz, J. N., & Harris, M. B. (2008). Clinical practice. Lumbar spinal stenosis. *New England Journal of Medicine*, 358(8), 818-825.
4. Kendall, F. P., McCreary, E. K., Provance, P. G., Rodgers, M. M., & Romani, W. A. (2005). *Muscles: Testing and Function with Posture and Pain* (5th ed.). Baltimore, MD: Lippincott Williams & Wilkins.
5. Lee, M. J., Bransford, R. J., Bellabarba, C., Chapman, J. R., & Cohen, A. M. (2010). The effect of nerve root compression on lumbar spine alignment in patients with degenerative conditions. *Spine*, 35(6), 642-647.
6. Lurie, J., & Tomkins-Lane, C. (2016). Management of lumbar spinal stenosis. *BMJ*, 352, h6234.
7. Negrini, S., Carabalona, R., & Sibilla, P. (2013). Effectiveness of trunk orthoses in adolescent idiopathic scoliosis. *Studies in Health Technology and Informatics*, 158, 20-23.
8. Schwab, F. J., Patel, A., Ungar, B., Farcy, J. P., & Lafage, V. (2009). Adult spinal deformity—Postoperative standing imbalance: How much can you tolerate? An overview of key parameters in assessing alignment and planning corrective surgery. *Spine*, 35(25), 2224-2231.

How to cite this article: Anupama Dhuria, Shallabh Kumar Singh, Poonam Pachauria. Impact of stenosis and neural foraminal compromise on low back pain and postural alignment. *Int J Health Sci Res.* 2025; 15(5):55-59. DOI: *10.52403/ijhsr.20250507*

******