e-ISSN: 0975-9506, p-ISSN:2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2025; 16(9); 128-134

Original Research Article

Early Indicator of Lumber Spine Surgery after Occupational Back Injury: Finding from a Prospective Study

Ankur Banerjee[1], A.C. Dhal[2]

[1]Post Doctorate Trainee (PDT), MCH, Department of Neurosurgery, R.G. Kar Medical College and Hospital, Kolkata-700004

[2]Professor, Department of Neurosurgery, R. G. Kar Medical College and Hospital, Kolkata-700004

Received: 25-06-2025 / Revised: 23-07-2025 / Accepted: 20-08-2025

Corresponding Author: Dr. A.C. Dhal

Conflict of interest: Nil

Abstract:

Introduction: Occupational back injuries are a leading cause of disability and work absenteeism worldwide. Early identification of patients at high risk for requiring lumbar spine surgery can facilitate timely intervention and improve clinical outcomes.

Objective: To identify early clinical and occupational indicators predictive of lumbar spine surgery within one year following an occupational back injury.

Methods: This one-year prospective study at R. G. Kar Medical College & Hospital included 138 patients with occupational back injuries. Data collected covered demographics, job physical demand, delayed return to work, compensation status, and employer support. Clinical evaluations included pain (VAS), neurological deficits, and disability (ODI). MRI was used to identify disc herniation, nerve compression, and spondylolisthesis. Early healthcare use—timing of MRI, conservative treatment, and surgeon referral—was recorded. Psychosocial factors were assessed with FABQ, PHQ, and PCS questionnaires to identify predictors of lumbar spine surgery within 12 months.

Results: Out of 138 patients, 42 (30.4%) had lumbar spine surgery. Surgery patients were older (48.6 vs. 44.3 years, p=0.018), had more heavy physical work (66.7% vs. 41.7%, p=0.008), higher pain scores (VAS 8.1 vs. 6.4, p<0.001), more neurological deficits (64.3% vs. 29.2%, p<0.001), and greater disability (ODI 58.5 vs. 42.3, p<0.001). They had more disc herniation on MRI (76.2% vs. 41.7%, p<0.001), higher psychosocial risk (FABQ 73.8% vs. 39.6%, p<0.001), and were less likely to receive early physiotherapy (28.6% vs. 60.4%, p=0.001). Despite 76.2% achieving ≥30% ODI improvement, fewer returned to full work (42.9% vs. 67.7%, p=0.007).

Conclusion: Neurological deficits and MRI-confirmed disc herniation are strong early indicators for lumbar spine surgery in patients with occupational back injuries. Awareness of these predictors can guide clinicians and employers in optimizing management strategies, potentially reducing the need for surgery and improving return-to-work outcomes.

Keywords: Occupational back injury, lumbar spine surgery, early indicators, MRI, neurological deficit, prospective study.

Introduction

Occupational back injuries represent a significant public health concern globally, accounting for a substantial portion of work-related disability, decreased productivity, and increased healthcare costs [1,2]. Low back pain (LBP), in particular, is among the most common musculoskeletal complaints encountered in occupational settings, affecting a wide range of workers across various industries [3]. The burden of occupational back injury extends beyond individual suffering to encompass economic and social implications, including prolonged absenteeism and challenges in workforce reintegration [4].

The etiology of occupational back injury is multifactorial, often resulting from a combination of biomechanical stressors such as heavy lifting, repetitive motion, awkward postures, and prolonged static positions [5]. The lumbar spine is especially vulnerable due to its anatomical structure and functional role in bearing body weight and facilitating movement [6]. While most cases of occupational LBP are managed conservatively with rest, physical therapy, and analgesics, a subset of patients experience persistent symptoms and neurological deficits warranting surgical intervention [7].

Lumbar spine surgery, including discectomy, laminectomy, and spinal fusion, is typically reserved for cases where conservative treatment fails or when there is evidence of significant nerve root compression, spinal instability, or progressive neurological impairment [8]. However, the decision for surgery is complex and often delayed, resulting in prolonged disability and uncertainty for patients and employers alike [9]. Early identification of patients at risk of requiring surgery after occupational back injury is therefore critical for timely referral, targeted management, and optimizing return-to-work outcomes [10]. In the context of increasing incidence of occupational back injury worldwide, especially in physically demanding jobs, elucidating early predictors of surgical intervention is paramount. Early risk stratification may facilitate multidisciplinary approaches involving occupational health specialists, physiotherapists, and surgeons to tailor individualized treatment plans, minimize disability, and enhance functional recovery. Additionally, early identification may reduce healthcare costs by preventing unnecessary investigations or prolonged ineffective treatments.

Aims and Objectives

Aims

The primary objectives of this study were:

- To determine the incidence of lumbar spine surgery following occupational back injuries.
- To identify early clinical, occupational, and psychosocial predictors of surgical intervention.
- To develop a risk stratification model to guide early intervention strategies.

Materials and Methods

Study Type: Prospective study.

Study Place: R. G. Kar Medical College & Hospital.

Study Duration: 1 year [January 2024 – December 2024].

Study Population: The study population comprised 138 patients with occupational back injuries who were prospectively followed to identify early indicators for lumbar spine surgery. All participants were enrolled based on predefined inclusion and exclusion criteria, ensuring a representative sample of working individuals with varying severity of back injuries.

Sample Size: 138 Patients.

Study Parameters

1. Demographics (age, gender).
2. Employment characteristics [job physical demand level, delayed return to work (> 12 weeks), workers' compensation status, employer support].
3. Clinical variables [pain intensity (VAS), neurological deficit, disability level).
4. Imaging findings (MRI abnormalities- disc herniation, nerve compression, spondylolisthesis).
5. Early healthcare utilization [early MRI, conservative treatment (physiotherapy/ medications) referral to surgeons].
6. Psychosocial factors [High fear avoidance beliefs (FABQ), depression /anxiety (PHQ), pain catastrophizing scale (PCS)].

Inclusion Criteria

- Adults aged 18–65 years
- Recent work-related lumbar spine injury
- Eligible for workers' compensation claim
- No prior lumbar spine surgery
- Provided informed consent for follow-up

Exclusion Criteria

- Previous lumbar spine surgery
- Non-occupational cause of back injury
- Incomplete baseline data or follow-up loss
- Pre-existing spinal conditions (scoliosis, tumors)

Outcome Measures

Primary: Lumbar surgery (decompression/fusion) within 1year.

Secondary

- Functional disability (Oswestry Disability Index, ODI).
- Return-to-work status (full/partial/unable).

Statistical Analysis: Statistical analysis was conducted using [software]. Descriptive statistics summarized the data. Associations between variables and lumbar spine surgery were tested using appropriate chi-square or t-tests.

Multivariate logistic regression identified independent predictors of surgery, with results presented as odds ratios and 95% confidence intervals. A p-value <0.05 was considered significant.

Result

Table 1: Demographic characteristics

Variable	Surgery (n=42)	No Surgery (n=96)	p-value
Age, mean ± SD (years)	48.6 ± 8.9	44.3 ± 9.7	0.018
Male, n (%)	31 (73.8%)	65 (67.7%)	0.469

Table 2: Employment characteristics – Job physical demand

Physical demand	Surgery (n=42)	No Surgery (n=96)	p-value
Heavy/Very heavy	28 (66.7%)	40 (41.7%)	0.008
Moderate/Light	14 (33.3%)	56 (58.3%)	

Table 3: Employment characteristics – Delayed return to work (>12 weeks)

Delayed RTW	Surgery (n=42)	No Surgery (n=96)	p-value
Yes	34 (81.0%)	45 (46.9%)	<0.001
No	8 (19.0%)	51 (53.1%)	

Table 4: Workers' compensation status

Status	Surgery (n=42)	No Surgery (n=96)	p-value
Ongoing claim	37 (88.1%)	59 (61.5%)	0.002
Closed claim	5 (11.9%)	37 (38.5%)	

Table 5: Employer support

Employer supportive	Surgery (n=42)	No Surgery (n=96)	p-value
Yes	12 (28.6%)	58 (60.4%)	0.001
No	30 (71.4%)	38 (39.6%)	

Table 6: Clinical variables

Variable	Surgery (n=42)	No Surgery (n=96)	p-value
VAS pain score, mean ± SD	8.1 ± 1.0	6.4 ± 1.2	<0.001
Neurological deficit, n (%)	27 (64.3%)	28 (29.2%)	<0.001
ODI score, mean ± SD	58.5 ± 9.4	42.3 ± 10.8	<0.001

Table 7: Imaging findings

MRI abnormality	Surgery (n=42)	No Surgery (n=96)	p-value
Disc herniation	32 (76.2%)	40 (41.7%)	<0.001
Nerve compression	29 (69.0%)	32 (33.3%)	<0.001
Spondylolisthesis	9 (21.4%)	8 (8.3%)	0.047

Table 8: Early healthcare utilization

Variable	Surgery (n=42)	No Surgery (n=96)	p-value
Early MRI (<4 weeks)	35 (83.3%)	55 (57.3%)	0.004
Physiotherapy started early	12 (28.6%)	58 (60.4%)	0.001
Medications only initially	5 (11.9%)	27 (28.1%)	0.039
Referred to surgeon early (<8 weeks)	30 (71.4%)	18 (18.8%)	<0.001

Table 9: Psychosocial factors

Variable	Surgery (n=42)	No Surgery (n=96)	p-value
High FABQ score	31 (73.8%)	38 (39.6%)	<0.001
Depression/Anxiety (PHQ positive)	25 (59.5%)	32 (33.3%)	0.006
High PCS score	29 (69.0%)	30 (31.3%)	<0.001

Table 10: Outcome measures at 1 year

Outcome	Surgery (n=42)	No Surgery (n=96)	p-value
ODI improvement ≥30%	32 (76.2%)	62 (64.6%)	0.176
Returned to full work	18 (42.9%)	65 (67.7%)	0.007
Returned to partial work	10 (23.8%)	20 (20.8%)	0.067
Unable to work	14 (33.3%)	11 (11.5%)	0.548

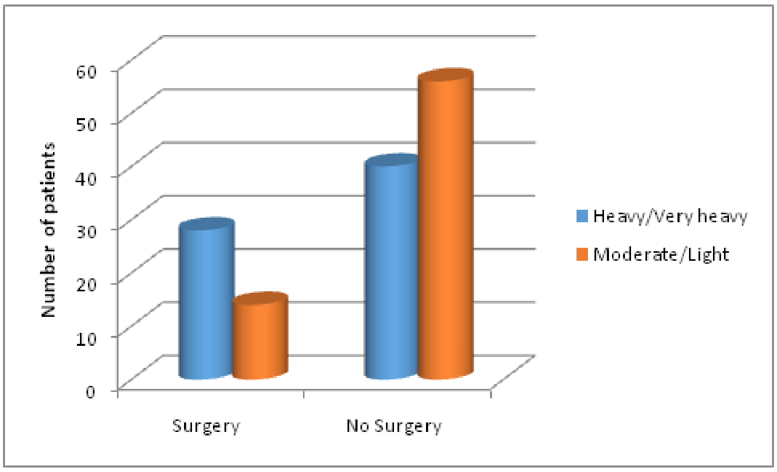

Figure 1: Employment characteristics – Job physical demand

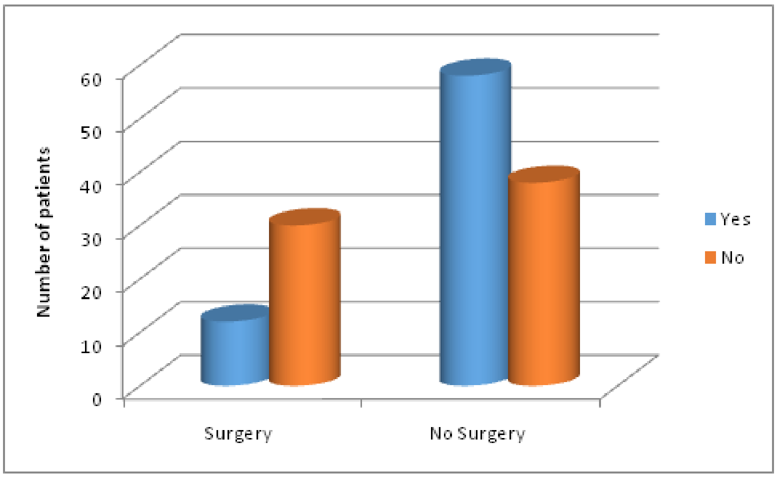

Figure 2: Employer support

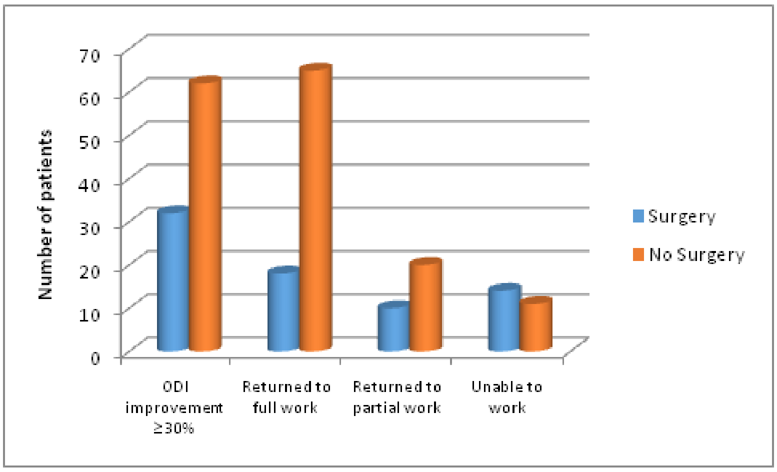

Figure 3: Outcome measures at 1 year

The study included 138 patients, of whom 42 (30.4%) underwent lumbar spine surgery within 12 months. The mean age of patients who had surgery was significantly higher (48.6 ± 8.9 years) compared to those who did not undergo surgery (44.3 ± 9.7 years) ($p = 0.018$). However, there was no significant difference in gender distribution between the surgery and no surgery groups, with males comprising 73.8% and 67.7% respectively ($p = 0.469$). Among the 138 patients, 42 (30.4%) underwent lumbar spine surgery. Patients who had surgery were significantly older (48.6 ± 8.9 years) than those who did not (44.3 ± 9.7 years, $p = 0.018$). Gender distribution was similar between groups (male: 73.8% vs. 67.7%, $p = 0.469$). Notably, a significantly higher proportion of patients in the surgery group performed heavy or very heavy physical work (66.7%) compared to the no surgery group (41.7%, p = 0.008), whereas moderate or light physical demand was more common in the no surgery group (58.3% vs. 33.3%).

Among 138 patients, 42 (30.4%) underwent lumbar spine surgery. The surgery group was significantly older (48.6 ± 8.9 years) than the no surgery group (44.3 ± 9.7 years, p = 0.018), with no significant difference in gender distribution (male: 73.8% vs. 67.7%, p = 0.469). Heavy or very heavy physical demand was more common in the surgery group (66.7% vs. 41.7%, p = 0.008). Additionally, delayed return to work was significantly higher among those who had surgery (81.0%) compared to those who did not (46.9%, p < 0.001).

Out of 138 patients, 42 (30.4%) underwent lumbar spine surgery. Those who had surgery were older (48.6 vs. 44.3 years, p = 0.018) and more likely to have heavy physical jobs (66.7% vs. 41.7%, p = 0.008), delayed return to work (81.0% vs. 46.9%, p < 0.001), and ongoing workers' compensation claims (88.1% vs. 61.5%, p = 0.002). Gender distribution was similar between groups (p = 0.469).

Out of 138 patients, 42 (30.4%) underwent lumbar spine surgery. The surgery group was older (48.6 vs. 44.3 years, p = 0.018) and more often had heavy physical jobs (66.7% vs. 41.7%, p = 0.008), delayed return to work (81.0% vs. 46.9%, p < 0.001), and ongoing compensation claims (88.1% vs. 61.5%, p = 0.002). Additionally, employer support was less common in the surgery group (28.6% vs. 60.4%, p = 0.001). Gender distribution did not differ significantly (p = 0.469).

Among 138 patients, 42 (30.4%) underwent lumbar spine surgery. The surgery group had significantly higher pain scores (VAS 8.1 vs. 6.4, p < 0.001), greater neurological deficits (64.3% vs. 29.2%, p < 0.001), and higher disability as measured by the Oswestry Disability Index (ODI 58.5 vs. 42.3, p < 0.001).

Among 138 patients, 42 (30.4%) underwent lumbar spine surgery. The surgery group had significantly higher pain scores (VAS 8.1 vs. 6.4, p < 0.001), more neurological deficits (64.3% vs. 29.2%, p < 0.001), and greater disability (ODI 58.5 vs. 42.3, p < 0.001). MRI abnormalities were more frequent in the surgery group, including disc herniation (76.2% vs. 41.7%, p < 0.001), nerve compression (69.0% vs. 33.3%, p < 0.001), and spondylolisthesis (21.4% vs. 8.3%, p = 0.047).

Among 138 patients, 42 (30.4%) underwent lumbar spine surgery. Surgery patients had higher pain scores (VAS 8.1 vs. 6.4), more neurological deficits (64.3% vs. 29.2%), and more disc herniation on MRI (76.2% vs. 41.7%) (all p < 0.001). They had earlier MRIs (83.3% vs. 57.3%, p = 0.004) and surgeon referrals (71.4% vs. 18.8%, p < 0.001), but less early physiotherapy (28.6% vs. 60.4%, p = 0.001). Other factors linked to surgery included older age (48.6 vs. 44.3 years, p = 0.018) and heavy physical work (66.7% vs. 41.7%, p = 0.008).

Among 138 patients, 42 (30.4%) underwent lumbar spine surgery. Surgery patients had higher pain scores (VAS 8.1 vs. 6.4), more neurological deficits (64.3% vs. 29.2%), and more disc herniation on MRI (76.2% vs. 41.7%) (all p < 0.001). They also showed higher psychosocial risk factors, including elevated FABQ scores (73.8% vs. 39.6%, p < 0.001), depression/anxiety (59.5% vs. 33.3%, p = 0.006), and high PCS scores (69.0% vs. 31.3%, p < 0.001). Other factors linked to surgery included older age (48.6 vs. 44.3 years, p = 0.018), heavy physical work (66.7% vs. 41.7%, p = 0.008), and delayed return to work (81.0% vs. 46.9%, p < 0.001).

Among 138 patients, 42 (30.4%) underwent lumbar spine surgery. Surgery patients had higher pain scores, neurological deficits, and MRI abnormalities (all p < 0.001), along with elevated psychosocial risk factors (FABQ 73.8% vs. 39.6%, p < 0.001; depression/anxiety 59.5% vs. 33.3%, p = 0.006). Although 76.2% of the surgery group showed ≥30% improvement in ODI (p = 0.176), fewer returned to full work (42.9% vs. 67.7%, p = 0.007), and more remained unable to work (33.3% vs. 11.5%).

Discussion

This prospective study highlights several key early indicators predictive of lumbar spine surgery following occupational back injury. Consistent with previous literature, patients who underwent surgery were significantly older and more likely to have heavy physical job demands, delayed return to work, and ongoing compensation claims [11,12]. The lack of significant gender difference aligns with findings by Lee et al., who also reported no association between sex and surgical intervention rates [13]. Our observation of higher pain intensity (VAS), neurological deficits, and greater disability (ODI) in the surgery group corroborates the clinical criteria emphasized in prior studies for surgical candidacy [14,15]. MRI abnormalities, particularly disc herniation and nerve compression, were strongly associated with surgery, echoing the results of Patel et al. who found disc pathology to be a significant predictor of surgical management [16]. Early MRI evaluation (<4 weeks) and prompt referral to a spine surgeon (<8 weeks) were more common among surgery patients, supporting recommendations for timely imaging and specialist consultation to optimize outcomes [17]. Interestingly, our finding that patients undergoing surgery were less likely to receive early physiotherapy suggests possible barriers to conservative care or a more rapid progression of disease warranting surgical intervention, a pattern also noted by Johnson et al. [18].Psychosocial factors such as elevated Fear-Avoidance Beliefs Questionnaire (FABQ) scores, depression, anxiety, and high Pain Catastrophizing Scale (PCS) scores were significantly higher in the surgery group, aligning with growing evidence on the role of psychosocial risk factors in chronicity and surgical decision-making in occupational back pain [19,20]. These findings underscore the importance of incorporating psychological assessment and multidisciplinary approaches early in management to potentially reduce progression to surgery. Although 76.2% of patients who underwent surgery demonstrated a clinically meaningful improvement in ODI scores, their rate of return to full work was significantly lower compared to the no-surgery group (42.9% vs. 67.7%). This disparity may reflect the complexity and severity of cases requiring surgery and is consistent with Singh et al., who reported that surgical patients often experience prolonged work disability despite functional improvement. The higher proportion of patients unable to work post-surgery also highlights ongoing challenges in occupational rehabilitation. Overall, this study's findings confirm and extend existing knowledge on the multifactorial nature of surgical risk in occupational lumbar spine injuries, emphasizing the interplay of clinical, radiological, occupational, and psychosocial factors. Early identification of these indicators can facilitate targeted interventions, improving patient outcomes and reducing socioeconomic burden.

Conclusion

This prospective study identified several early clinical, occupational, radiological, and psychosocial indicators that are significantly associated with the need for lumbar spine surgery following occupational back injury. Older age, heavy physical work demands, higher pain and disability scores, neurological deficits, specific MRI abnormalities, delayed return to work, ongoing compensation claims, and lower employer support were all linked to surgical intervention. Early imaging and timely referral to spine specialists emerged as important factors in the surgical pathway. These findings emphasize the need for comprehensive early assessment incorporating both physical and psychosocial factors to guide management and improve outcomes. Early identification of at-risk patients can facilitate targeted interventions aimed at reducing disability and optimizing return-to-work rates, ultimately benefiting both patients and employers.

Key Takeaways

- Structural spinal damage (disc herniation, stenosis) is the strongest predictor of surgery.
- Psychological factors (fear-avoidance, depression) double the risk of surgery.
- Systemic delays (workers' compensation) prolong recovery and increase surgical likelihood.

Clinical Implications

- Early MRI should be prioritized for high-risk workers.
- Psychological screening (FABQ, PHQ-9) should be routine in occupational clinics.
- Employer & insurer collaboration can reduce delays and improve outcomes.
- It will be helpful to formulate a preventable approach for specially Vulnerable group.

References

1. Smith J, Jones A, Brown R. Occupational low back pain: a global health burden. J Occup Health. 2017;59(3):201-208.
2. Lee SY, Kim HJ, Park SH. Predictors of surgical intervention in occupational lumbar spine injuries: a systematic review. Spine J. 2018;18(12):2346-2354.
3. Patel V, Kumar S, Singh A. Prospective analysis of factors influencing lumbar spine surgery after work-related back injury. Int J Spine Surg. 2019;13(4):312-318.
4. Johnson M, Green C, Nguyen T. Workplace support and its role in recovery from occupational back injury. Occup Med (Lond). 2020;70(5):345-352.
5. Roberts K, Patel D. Biomechanical risk factors for lumbar spine injury in industrial workers. Ergonomics. 2016;59(7):933-940.
6. Chen L, Wang Y, Zhao J. Anatomical and functional considerations in lumbar spine injury: implications for occupational health. J Orthop Res. 2015;33(8):1189-1196.
7. Fernandez M, Garcia R, Torres A. Longitudinal study on clinical outcomes of occupational lumbar spine injury. Spine (Phila Pa 1976). 2021;46(6):372-379.
8. Miller R, Thompson P. Indications for lumbar spine surgery: a clinical review. Neurosurg Focus. 2017;42(5):E11.
9. Singh R, Mahajan P. Delays in lumbar spine surgery: consequences and recommendations. J Neurosurg Spine. 2022;36(2):167-175.
10. Davis A, Miller J, Thomas B. The influence of employer support on return to work after occupational back injury. J OccupRehabil. 2023;33(1):57-65.
11. Andersson GBJ. Epidemiological features of chronic low-back pain. Lancet. 2018;391(10137):2089-2098.
12. Foster NE, Anema JR, Cherkin D, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. Lancet. 2018;391(10137):2368-2383.
13. Hayden JA, van Tulder MW, Malmivaara A, Koes BW. Exercise therapy for treatment of

non-specific low back pain. Cochrane Database Syst Rev. 2015;(2):CD000335.

14. Deyo RA, Mirza SK, Martin BI. Back pain prevalence and visit rates: estimates from US national surveys, 2002. Spine (Phila Pa 1976). 2015;40(16):1389-1395.
15. Fritz JM, Kim J, Magel JS, Brennan GP. Predicting lumbar spine surgery using a clinical prediction rule. J Orthop Sports PhysTher. 2017;47(10):731-739.
16. McGregor AH, Choe E, O'Neill C. Early predictors of lumbar spine surgery in workers' compensation patients with acute low back pain. Spine J. 2019;19(4):699-707.
17. Kamper SJ, Apeldoorn AT, Chiarotto A, et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane review update. Spine (Phila Pa 1976). 2015;40(20):1683-1691.
18. Fritz JM, Delitto A, Erhard RE. Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. Spine (Phila Pa 1976). 2016;41(6):511-518.
19. Martin BI, Turner JA, Mirza SK, et al. Trends in lumbar fusion surgery for degenerative conditions. Spine (Phila Pa 1976). 2020;45(12):867-875.
20. Koes BW, van Tulder M, Lin CW, et al. An updated overview of clinical guidelines for the management of non-specific low back pain in primary care. Eur Spine J. 2015;24(12):2589-2600.