

Clinical Outcomes of Integrative Korean Medicine Treatment in Patients with Neck Pain Following Cervical Disc Surgery: A Multi-Center Retrospective Study

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Purpose: This study aimed to evaluate the clinical outcomes of integrative Korean medicine treatment in reducing pain, improving function, and enhancing quality of life for patients who had undergone cervical disc surgery.

Patients and Methods: A retrospective review was performed on the electronic medical records (EMR) of 181 patients diagnosed with cervical disc herniation on cervical spine magnetic resonance imaging (MRI) scans among those hospitalized for cervical pain following cervical disc surgery at four Korean medicine hospitals in Korea between January 1, 2015, and December 31, 2022. The analysis was based on EMR collected from admission to discharge during the inpatient period. The primary outcome was the Numeric Rating Scale (NRS) score for neck pain, and the secondary outcome measures were the Vernon-Mior Neck Disability Index (NDI), the 5-level EuroQol 5-Dimension (EQ-5D-5L), the Patient Global Impression of Change, and range of motion. Disc degeneration grade and herniation area were assessed for all patients using MRI.

Results: Of the 181 patients screened, 142 met the inclusion criteria. The mean neck pain NRS score decreased from 5.61 ± 1.41 at admission to 3.52 ± 1.4 at discharge (difference: -2.09 , 95% CI -2.32 to -1.85 , $p < 0.001$), and the NDI score from 40.61 ± 18.44 at admission to 31.3 ± 17.05 at discharge (difference: -9.31 , 95% CI -11.74 to -6.87 , $p < 0.001$). Post-treatment improvements were observed in all outcomes, including the NRS score for radiating arm pain (difference: -2.11 , 95% CI -2.40 to -1.82 , $p < 0.001$) and the EQ-5D-5L scores (difference: 0.07 , 95% CI 0.05 to 0.09 , $p < 0.001$); however, no significant differences in outcomes were observed according to the disc degeneration grade.

Conclusion: Integrative Korean medicine is associated with short-term improvements of pain, function and quality of life of patients following cervical disc surgery.

Plain Language Summary: Neck pain is a common complaint after surgery for cervical disc problems, and many patients continue to experience discomfort and limited function even after the procedure. In Korea, integrative Korean medicine—which includes treatments such as acupuncture, herbal medicine, pharmacopuncture, and manual therapy—is commonly used to manage spinal conditions. However, few studies have evaluated its effects specifically in patients who have already undergone cervical disc surgery. This study looked at 145 patients who were hospitalized with neck pain after cervical disc surgery at four Korean medicine hospitals. They received a combination of Korean medicine treatments during their stay. The researchers reviewed the patients' medical records to examine changes in pain, physical function, and quality of life before and after treatment. The results showed that patients reported significant reductions in neck pain and radiating arm pain, as well as improvements in daily functioning and overall quality of life. These improvements were measured using

standard clinical tools. The study also found that patients who stayed in the hospital for 14 days or more showed greater benefits. No serious side effects were reported. While more rigorous studies are needed to confirm these findings, the results suggest that integrative Korean medicine may be a helpful and safe option for managing persistent symptoms after cervical disc surgery.

Keywords: neck surgery, cervical disc disorder, acupuncture, Chuna manual therapy, pharmacopuncture

Introduction

Cervical disc disorder is a clinical syndrome caused by structural abnormalities of the cervical spine, wherein the cervical intervertebral disc compresses the cervical nerve roots. It is a leading cause of neck pain. Affected individuals experience neck pain along with varying degrees of radiating arm pain, muscle weakness, and sensory abnormalities in the upper extremities, depending on the severity of cervical nerve root compression.¹ The global prevalence of cervical disc disorder has been increasing,² and, consequently, so have the associated socioeconomic costs on the patients and health care systems.

Conservative treatments for cervical disc disorder include nonsteroidal anti-inflammatory drugs, steroid injections, physical therapy, and rest.³ Surgical treatment is performed on patients who do not respond to conservative treatments or who have progressive neurological symptoms, with anterior cervical discectomy and fusion, and posterior laminectomy being standard procedures.^{4–6}

The number of cervical disc surgeries and the associated costs are increasing,⁷ however, surgery does not always yield satisfactory outcomes as neck pain, dysphagia, and paralysis, among other surgery-associated complications, have been reported post-operatively.^{8–11} Furthermore, there are many cases where symptoms do not improve post-surgery, necessitating rehospitalization or resulting in recurrence.^{12,13} Such persistent pain after surgery, often referred to as failed back or neck surgery syndrome, has been reported to occur in approximately 10–40%^{14,15} of patients and represents a significant global health issue due to its considerable socioeconomic burden.¹⁶

Medical and scientific consensus regarding the impact of the degree of disc herniation on magnetic resonance imaging (MRI) and fusion surgery on postoperative prognosis remains inconsistent. Some studies have suggested that magnetic resonance image (MRI) signal changes in the cervical disc may serve as important indicators for postoperative prognosis after cervical spine surgery,¹⁷ whereas other studies have reported that the location and type of herniation itself do not have a significant impact.¹⁸ Regarding fusion surgery, although one study reported that baseline patient conditions have a greater influence on long-term prognosis,¹⁹ others have indicated that the cervical disc arthroplasty group showed significantly better outcomes in terms of pain and reoperation rates than the fusion surgery group.²⁰

Meanwhile, Korea has a dual medical system that integrates Western and traditional Korean medicine (KM). KM treatment modalities included acupuncture, Chuna manual therapy, and pharmacopuncture.²¹ Among these modalities, acupuncture has been actively studied for its effects on postoperative pain. A systematic review reported that patients who received acupuncture on the first postoperative day required less opioid analgesics than those who did not.²² In addition, several studies have reported beneficial effects of various integrative medicine,²³ including acupuncture,²⁴ electroacupuncture,²⁵ and acupotomy²⁶ in patients with failed back surgery syndrome.

However, most previous studies were limited to case reports²⁶ or observational designs,²³ and even the few randomized controlled trials (RCTs) available were of low methodological quality.²⁵ In particular, to the best of our knowledge, research specifically targeting patients with neck pain following cervical spine surgery is scarce,^{27–30} highlighting the need for further investigation into integrative Korean medicine treatments in this population.

Therefore, this study aimed to evaluate the clinical outcomes of integrative Korean medicine inpatient treatment in patients with symptoms following cervical disc surgery, by comparing pain and function outcomes before and after hospitalization according to factors such as the presence of fusion surgery and the degree of disc herniation on MRI.

Materials and Methods

Study Design

A retrospective analysis of medical records of patients aged 19–69 years with a history of cervical disc surgery and hospitalization for cervical pain was performed at four Korean medicine hospitals: Jaseng Hospital of Korean Medicine,

Bucheon Jaseng Hospital of Korean Medicine, Daejeon Jaseng Hospital of Korean Medicine, and Haeundae Jaseng Hospital of Korean Medicine, between January 1, 2015, and December 31, 2022. These hospitals, which are spine-specialty hospitals of Korean medicine, designated and accredited by the Korean Ministry of Health and Welfare. They provide integrative Korean medicine treatments based on modern medical diagnostics. Using the electronic medical records (EMRs) of each hospital, patients' basic demographics, medical history, illnesses, types and durations of treatment, outcomes, including the Numeric Rating Scale (NRS), range of motion (ROM), and quality of life scores, among other information, were reviewed. In cases where patients were hospitalized more than once during the study period, the outcome data from the most recent hospitalization were used.

All participating hospitals were affiliated with the same medical foundation and used an integrated electronic medical record (EMR) system. Diagnostic codes, procedure codes were standardized across institutions. Data extraction was performed using predefined variables and coding rules to ensure consistency among hospitals.

As this was a retrospective observational study, no formal sample size calculation was conducted. Instead, all patients who met the eligibility criteria within the study period were included.

This study was approved by the Institutional Review Board of Jaseng Hospital of Korean Medicine (approval no.: JASENG 2023-09-043; approval date: September 27, 2023), and informed consent was waived due to the retrospective nature of the study. Patient consent was waived because the analysis was conducted using de-identified and encrypted data, making it impossible to obtain consent from individual patients, and the study posed no risk of harm to them. All patient data were handled confidentially in accordance with institutional and ethical standards. It was conducted in accordance with the Declaration of Helsinki and confirmed to STROBE guidelines.

Participants

Inclusion Criteria

The inclusion criteria were as follows: patients aged 19–69 years with a history of cervical disc surgery and who were hospitalized at the study institutions for cervical pain. Only patients who had undergone cervical spine MRI and were diagnosed with cervical disc disorder based on the radiologist's MRI interpretation or the assessment of a Korean medicine doctor were included.

Exclusion Criteria

Patients were excluded if they had a hospitalization period of ≤ 4 days, a history of cervical disc surgery >10 years prior, or other chronic diseases that could interfere with the interpretation of treatment effects or outcomes. Patients whose pain was not spinal in origin or attributed to soft tissue conditions (eg, tumors, fibromyalgia, rheumatoid arthritis, gout), those with ongoing neurological deficits or severe neurological symptoms, those deemed unsuitable for study participation by the authors of this study were also excluded. Patients hospitalized for ≤ 4 days were excluded because this duration was considered insufficient to evaluate meaningful clinical improvement.

Treatment

During hospitalization, patients received integrative Korean medicine treatment, which included herbal medicine, acupuncture, pharmacopuncture, Chuna manual therapy, moxibustion, and cupping therapy.

As this study was observational in nature, no predefined treatment protocol was applied, and treatment modalities or durations were not controlled. All interventions were administered at the discretion of the attending physicians according to each patient's clinical condition.

Data related to these treatments were collected from the EMR.

During Chuna manual therapy, a Korean medicine doctor physically stimulates the body's structural components using the hands, other parts of the body, or assistive devices.³¹ The treatment focused on the cervical region and included joint mobilization, myofascial, joint distraction, and joint correction Chuna techniques. Chuna manual therapy was performed once daily before acupuncture treatment during hospitalization, with each session lasting approximately 10 min. The treatment method was determined by trained Korean medicine doctors who had completed a standardized Chuna education program.

Pharmacopuncture was administered by injecting 1 mL of herbal extract into acupuncture points using standardized disposable insulin syringes (29 G × 13 mm, 1 mL, Sungshim Medical, Korea). The injections were administered once or twice daily at acupuncture and Ashi points selected at the discretion of the Korean medicine physician. The herbal extracts used for pharmacopuncture were selected by the physician based on the patient's symptoms. Pharmacopuncture treatment was performed following acupuncture treatment.

Acupuncture treatment was performed using disposable needles (0.25 × 30 mm; DongBang Acupuncture Needles, South Korea), targeting Ashi and standardized acupuncture points, including BL10, TE14, GB20, and GV16. Depending on the acupuncture point, the needles were inserted either vertically or obliquely and left in place for 15 min.

Acupuncture treatment was administered twice daily during the hospitalization period, in principle; however, the frequency was adjusted according to the patient's symptoms and needs. Electroacupuncture was performed using the StraTek STN-111 device (StraTek, Anyang, Korea). Electroacupuncture was also administered twice daily, following the same schedule as acupuncture treatment.

Herbal medicine treatment was administered two to three times daily, 30 min after meals, based on prescriptions determined by the Korean medicine physician.

Additional treatments included physical therapy based on Korean medicine and conventional physical therapy, administered collaboratively care by Korean medicine and Western medicine physicians. For physical therapy based on Korean medicine, herbal steam therapy was applied using a herbal pack containing 23 medicinal herbs with anti-inflammatory and analgesic properties, such as *Achyranthes bidentata* Blume, *Saposhnikovia Radix*, and *Angelicae Dahuricae Radix*. The herbal pack was applied to the cervical region for 15 to 20 min once daily. In addition, when necessary, conventional physical therapies, such as manual and extracorporeal shockwave therapies, were provided through consultation with a physician.

Integrative Korean medicine inpatient treatment was administered at the discretion of the Korean medicine physician throughout the hospitalization period. The number of doses administered for herbal medicine was recorded, as was the number of treatment sessions for the other interventions.

Outcome Measures

Primary Outcome

Numeric Rating Scale

The Numeric Rating Scale (NRS) is a numerical pain scale used to objectively quantify the patient's subjective pain, with 0 representing no pain and 10 representing unbearable pain. The NRS for cervical pain was measured three times: at admission, 2 weeks post-admission, and discharge. From admission through the treatment period, cervical pain and radiating arm pain were comprehensively assessed once daily between 7:00 and 8:00 a.m.³²

Secondary Outcomes

Neck Disability Index

The patient's functional status was assessed using the Neck Disability Index (NDI) questionnaire. The NDI, designed to assess the degree of cervical functional disability in daily life, is calculated by averaging the total score by the number of items answered. It consists of 10 questionnaire items, each scored from 0 to 5, with a total possible score of 50 points. Higher scores indicate greater disability. In this study, the NDI was assessed at admission, 2 weeks following admission, and discharge.³³

5-Level EuroQol 5-Dimension

The 5-Level EuroQol 5-dimension (EQ-5D-5L) is a widely used instrument in the healthcare field developed to assess health-related quality of life. The EQ-5D-5L consists of five items assessing current health status: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with each dimension evaluated on five levels: Level 1: no problems; Level 2: slight problems; Level 3: moderate problems; Level 4: severe problems; Level 5: extreme problems. In this study, the health-related quality of life index was calculated using a specific value set estimated for the Korean population. Assessments were conducted at admission, 2 weeks following admission, and discharge.³⁴

Range of Motion

Range of Motion (ROM) was used to assess the maximum active cervical joint mobility that the patient could perform without pain. The ROM was evaluated for flexion, extension, lateral flexion, and rotation and assessed at admission, 2 weeks following admission, and discharge. ROM was visually assessed by Korean medicine doctors with at least one year of clinical experience. Prior to data collection, the assessors received standardized training to minimize interobserver variability and ensure consistency in the evaluations.³⁵

Statistical Analysis

All statistical analyses were conducted using two-tailed tests, with a significance level of 5%. For the basic characteristics of the study population, continuous variables are presented as means and standard deviations, while categorical variables as frequencies and percentages. Regarding treatment details, the presence or absence of each treatment is presented as the number of patients and percentage, while the number of treatment sessions as the mean and standard deviation. The continuous outcome values at admission and discharge are presented as means and standard deviations. The change in outcomes at discharge is presented with 95% confidence intervals (CIs). *p*-values were calculated using paired *t*-tests. For sensitivity analysis, outcome values at admission, at discharge, and the changes were recalculated using a dataset in which missing values were imputed through multiple imputation. Paired *t*-tests were also used to calculate *p*-values in this analysis. Age and sex were included as covariates in the multiple imputation process, and a total of 20 imputations were performed. For neck pain and NDI, changes from baseline were analyzed by subgroup. Subgroups were classified based on sex, age, disc herniation grade, presence of fusion surgery, and length of stay. Age was categorized as < 60 years and ≥ 60 years; disc herniation grade was classified as extrusion or higher versus other findings; length of stay was categorized as < 14 days and ≥ 14 days; differences in outcome between each subgroup were analyzed using *t*-tests, and reported as *p*-values.

In addition, factors influencing improvement in neck pain NRS and NDI were analyzed using a multivariate logistic regression model. Improvement was defined as achieving the minimum clinically important difference (MCID), set at 2 points for neck pain NRS and 7.5 for NDI.³⁶ The dependent variables in this model were the NRS and NDI. Independent variables included sex, age, disc herniation grade, presence of fusion surgery, and length of hospital stay. Age was categorized into six groups: 20s (including 19 years), 30s, 40s, 50s, and ≥60 years. Length of stay was classified as <14 days or ≥14 days. Disc herniation grade was categorized into four stages: degeneration, bulging, protrusion, and extrusion. For each variable, odds ratios (ORs) and 95% CIs were reported, and the area under the curve (AUC) for the multivariate model was also presented.

Results

Study Flow

From January 1, 2015, to December 31, 2022, the data of 181 patients with a history of cervical disc surgery who were hospitalized for cervical pain at four integrative medicine hospitals in Korea were screened: 39 patients who did not meet the inclusion criteria—such as those with a hospitalization period of ≤ 4—were excluded, leaving 142 to be included in the final analysis (Figure 1).

Baseline Characteristics

The baseline characteristics of the study participants are presented in Table 1. The mean age of the patients was 51.10 ± 9.59 years. Among the 142 patients, 74 (52.11%) were men. The mean length of hospital stay was 17.10 ± 13.16 days, with the most common duration reported in 72 patients (50.70%) being 5–13 days. The most frequently affected spinal level with major abnormal findings was C6/7, observed in 31 patients (32.29%). The mean disc herniation area was 41.78 ± 22.54 mm², and 46 patients (47.92%) had extrusion-type herniation. Among the 102 patients for whom data on fusion surgery were available, underwent fusion surgery whereas 50 (49.02%) did not.

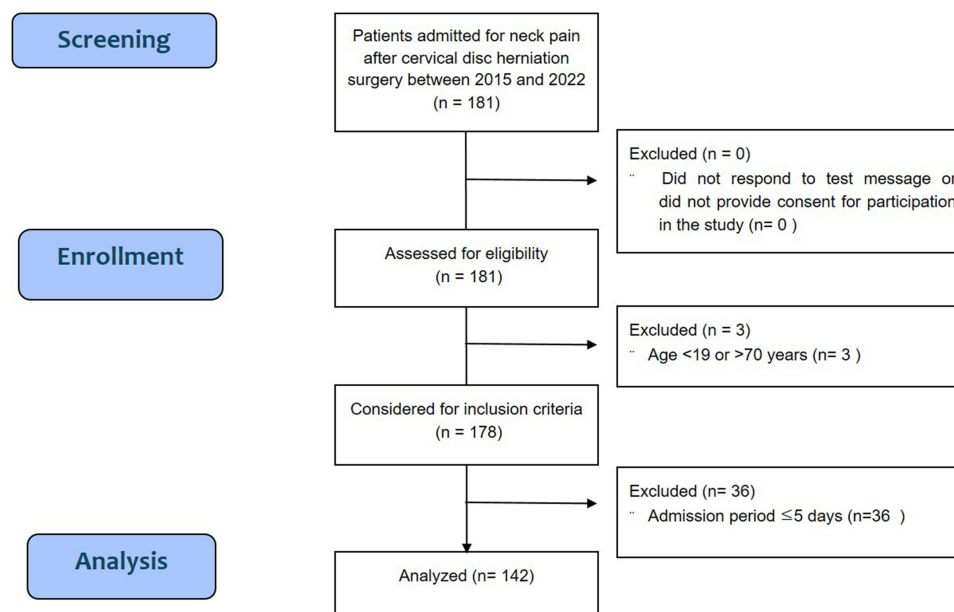


Figure 1 Study flowchart.

Treatments

The treatments received by the patients are summarized in [Table 2](#). Acupuncture and electroacupuncture were the most frequently administered treatments, prescribed to 141 patients (99.30%) and 136 patients (95.77%), respectively, with 28.11 ± 19.77 mean number of sessions for both. Chuna manual therapy was administered to 110 patients (77.46%), pharmacopuncture to 74 patients (52.11%), and herbal medicine to 78 patients (54.93%).

Post-Treatment Changes in the Values

The changes in outcomes before and after treatment are presented in [Table 3](#). Significant improvements were observed in all outcomes following treatment, including NRS scores for neck and radiating arm pain, EQ-5D-5L, NDI, and ROM. The NRS score for neck pain decreased by 2.09 points (95% CI: -2.32 to -1.85), and the NRS score for radiating arm pain decreased by 2.11 points (95% CI: -2.40 to -1.82). The EQ-5D-5L score increased by 0.07 points (95% CI: 0.05 to 0.09), whereas the NDI score decreased by 9.31 points (95% CI: -11.74 to -6.87). In the sensitivity analysis using multiple imputation to replace missing values with age and sex as covariates, significant improvements were confirmed in neck and radiating arm pain, EQ-5D-5L, and NDI scores at discharge ([Supplementary Table 1](#)).

Subgroup Analysis

Changes in patient outcomes were compared through subgroup analyses based on sex, age, disc herniation grade, presence of fusion surgery, and length of hospital stay. For the NRS score of neck pain, no significant differences were observed between groups stratified based on sex, age, disc herniation grade, or fusion surgery status. However, patients with a hospital stay of ≥ 14 days showed significantly greater improvement in NRS scores (-2.33 ± 1.32) than those with a stay of < 14 days (-1.85 ± 1.45 , $p = 0.040$). For NDI scores, patients < 60 years showed significantly greater improvement (-10.67 ± 13.82) than those ≥ 60 years (-4.51 ± 16.28). Similarly, those with a hospital stay of ≥ 14 days exhibited significantly greater improvement in NDI scores (-13.6 ± 14.00) than those with a stay of < 14 days (-5.13 ± 13.97) ([Supplementary Table 2](#), [Figures 2 and 3](#)).

Factors Associated with Improvement

Factors influencing improvement in neck pain NRS and NDI scores at the long-term follow-up were analyzed using multivariate logistic regression ([Table 4](#)). For neck pain, patients with a hospital stay of ≥ 14 days had higher odds of

Table 1 Basic Characteristics of the Study Population

Variable		Total (n = 142)
Sex	Male	74 (52.11)
	Female	68 (47.89)
Age	Mean $\pm$ SD	51.10 $\pm$ 9.59
Age categories, years	19–29	3 (2.11)
	30–39	17 (11.97)
	40–49	41 (28.87)
	50–59	49 (34.51)
	$\geq$ 60	32 (22.54)
Height (n = 140)		165.76 $\pm$ 8.71
Weight (n = 140)		66.47 $\pm$ 12.27
BMI (n = 140)		24.05 $\pm$ 3.09
Length of stays (days)	Mean $\pm$ SD	17.10 $\pm$ 13.16
	5 to 13	72 (50.70)
	14 to 27	47 (33.10)
	$\geq$ 28	23 (16.20)
^aMajor finding level (n = 96)	C1/2	–
	C2/3	1 (1.04)
	C3/4	6 (6.25)
	C4/5	25 (26.04)
	C5/6	27 (28.12)
	C6/7	31 (32.29)
	C7/T1	6 (6.25)
^bDisc herniation area (n = 95)	Mean $\pm$ SD	41.78 $\pm$ 22.54
	Median [Q1, Q3]	37.27 [26.82, 54.45]
^cDisc herniation grade (n = 96)	Degeneration	1 (1.04)
	Bulging	9 (9.38)
	Protrusion	40 (41.67)
	Extrusion	46 (47.92)
Fusion surgery (n = 102)	No	50 (49.02)
	Yes	52 (50.98)

Notes: ^aMajor findings: In cases with abnormalities at multiple levels, the level with the most severe abnormal finding was used for analysis. ^bDisc herniation area: For each patient, the level with the largest herniation area was used for analysis. ^cDisc herniation grade: For each patient, the grade was determined based on the most severe abnormal finding.

Table 2 Treatment Details

Variable	N (%)	Frequency
Acupuncture	141 (99.30)	28.11 $\pm$ 19.77
Electroacupuncture	136 (95.77)	25.54 $\pm$ 19.64
Pharmacopuncture	74 (52.11)	19.13 $\pm$ 26.35
Bee venom pharmacopuncture	14 (9.86)	0.94 $\pm$ 3.24
Herbal medicine (Total)	78 (54.93)	65.06 $\pm$ 44.97
Herbal medicine (Cheongpajeon-herbal formula)	64 (45.07)	8.96 $\pm$ 13.90
Chuna manual therapy	110 (77.46)	11.06 $\pm$ 11.47
Manual therapy	53 (37.32)	4.62 $\pm$ 8.50
Electrotherapy	31 (21.83)	8.56 $\pm$ 21.14
Mechanical traction therapy	14 (9.86)	1.43 $\pm$ 5.27
Extracorporeal shockwave therapy	15 (10.56)	0.70 $\pm$ 2.55

Table 3 Post-Treatment Changes in Each Outcome

	n	Admission	Discharge	Difference	p
NRS of NP	141	5.61 ± 1.41	3.52 ± 1.40	-2.09 (-2.32 to -1.85)	< 0.001
NRS of RP	83	5.76 ± 1.26	3.65 ± 1.40	-2.11 (-2.40 to -1.82)	< 0.001
EQ-5D	137	0.68 ± 0.16	0.75 ± 0.13	0.07 (0.05 to 0.09)	< 0.001
NDI	140	40.61 ± 18.44	31.30 ± 17.05	-9.31 (-11.74 to -6.87)	< 0.001
ROM_flexion	117	42.14 ± 7.38	44.32 ± 3.65	2.18 (1.04 to 3.32)	< 0.001
ROM_extension	117	38.80 ± 11.92	43.12 ± 7.21	4.32 (2.52 to 6.11)	< 0.001
ROM_lateral flexion_R	116	38.62 ± 11.37	42.24 ± 7.50	3.62 (1.87 to 5.37)	< 0.001
ROM_lateral flexion_L	116	38.41 ± 11.49	42.07 ± 8.00	3.66 (2.01 to 5.31)	< 0.001
ROM_rotation_R	117	78.03 ± 19.95	84.53 ± 12.66	6.50 (3.58 to 9.41)	< 0.001
ROM_rotation_L	117	78.21 ± 20.19	85.17 ± 11.91	6.97 (4.07 to 9.86)	< 0.001

Notes: P value was calculated with paired *t* test.

Abbreviations: NRS, Numeric Rating Scale; NP, Neck pain; RP, Referred pain; EQ-5D, EuroQol 5-dimension; NDI, Neck Disability Index; ROM, Range of Motion.

improvement (OR 4.73, 95% CI: 1.79 to 12.47), as did those who had undergone fusion surgery (OR 3.36, 95% CI: 1.26 to 8.97), than their respective counterparts. For functional outcomes, patients with a hospital stay of ≥ 14 days also had significantly higher odds of recovery (OR 3.60, 95% CI: 1.46 to 8.91) than those with shorter stays. Other variables were not statistically significant.

Discussion

This study investigated the clinical outcomes of integrative Korean medicine treatment in adult patients hospitalized with persistent neck pain after cervical disc surgery. The findings indicated that integrative Korean medicine treatment was associated with improvements in pain, functional disability, and quality of life.

The results of this study showed that integrative Korean medicine treatment significantly improved pain and function in patients following cervical spine surgery. The mean NRS score significantly decreased from 5.61 at admission to 3.52 at discharge, and the NDI, a functional outcome measure, from 40.61 to 31.30. In particular, the NRS score decreased by more than 2 points, a meaningful reduction given that the MCID for neck pain is typically estimated to be between 1.5 and 2.5 points.^{37–41}

The EQ-5D-5L score also improved from 0.68 to 0.75, indicating that integrative Korean medicine treatment over a short period contributed to enhancing patients' quality of life. Patients with neuropathic pain are known to have lower quality of life compared not only to the general population,⁴² but also to patients with chronic heart failure.⁴³ In particular, patients who experience failed back surgery may suffer from even poorer quality of life,⁴⁴ necessitating efforts to improve their well-being. Although there is no universally established MCID for EQ-5D-5L in post-cervical surgery patients, one study involving patients who underwent cervical discectomy reported an estimated MCID range of 0.05–0.24,⁴⁵ while another on laminoplasty patients reported an MCID of 0.0485.⁴⁶ Therefore, the observed improvement in EQ-5D-5L from 0.68 to 0.75 during hospitalization in this study can be considered a clinically meaningful enhancement.

In addition to improvements in pain and functional disability, significant gains were observed in cervical range of motion (ROM) across all directions, including flexion, extension, lateral flexion, and rotation. Restoration of cervical mobility is an important therapeutic goal after cervical disc surgery, as limited ROM can contribute to persistent discomfort and impaired function. The observed increases in ROM suggest that integrative Korean medicine treatment, incorporating manual therapy and acupuncture, may help enhance neck flexibility and support postoperative rehabilitation.

Herein, the length of hospital stay was identified as a significant factor influencing patient improvement. Approximately 50% of the participants were hospitalized for ≥ 14 days. This group showed significantly greater improvements in neck pain scores and NDI, suggesting that the greater improvements may be achieved when integrative Korean medicine treatment is administered continuously over a sufficient period. Previous studies have reported that the average length of hospitalization for patients admitted to Korean medicine hospitals owing to cervical disc herniation ranged between 17 and 22 days.⁴⁷ Although

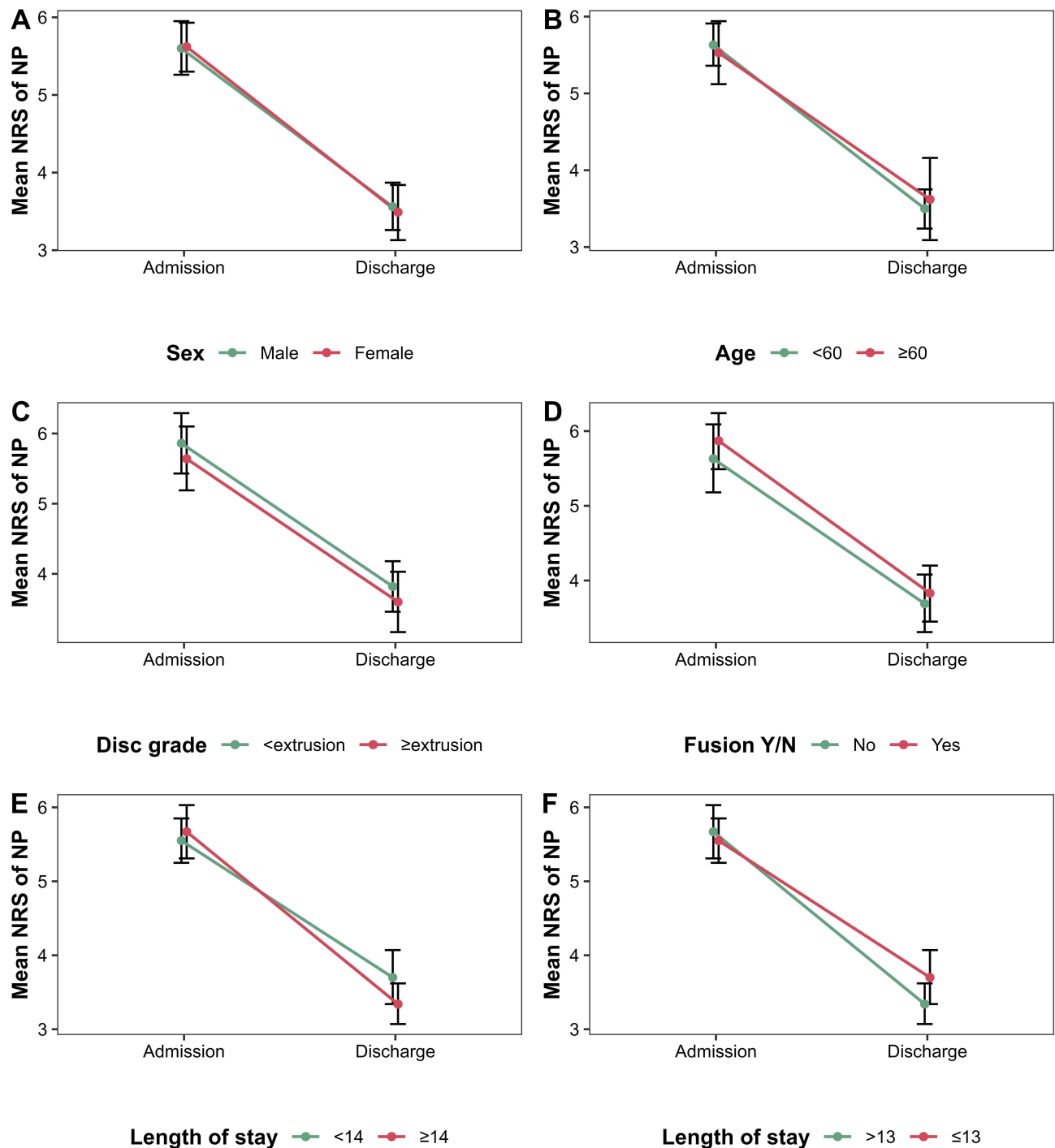


Figure 2 Difference in the change of numeric rating scale for neck pain based on (A) sex, (B) age, (C) disc herniation grade, (D) fusion surgery, and (E) length of hospital stay. **Abbreviations:** NRS, Numeric Rating Scale; NP, Neck pain.

treatment duration is determined based on the patient's condition, sustained and intensive Korean medicine treatment may contribute to improvements in symptoms and quality of life.

In addition, MRI imaging was used to confirm the presence of fusion surgery and assess the degree of disc herniation in all patients, and there were no significant differences. This finding suggests that the extent of disc herniation observed on MRI is not a key determinant of treatment prognosis, and that patients with severe herniation benefit from Korean medicine treatment. However, this finding remains debatable^{18,19,48} and warrants further investigation.

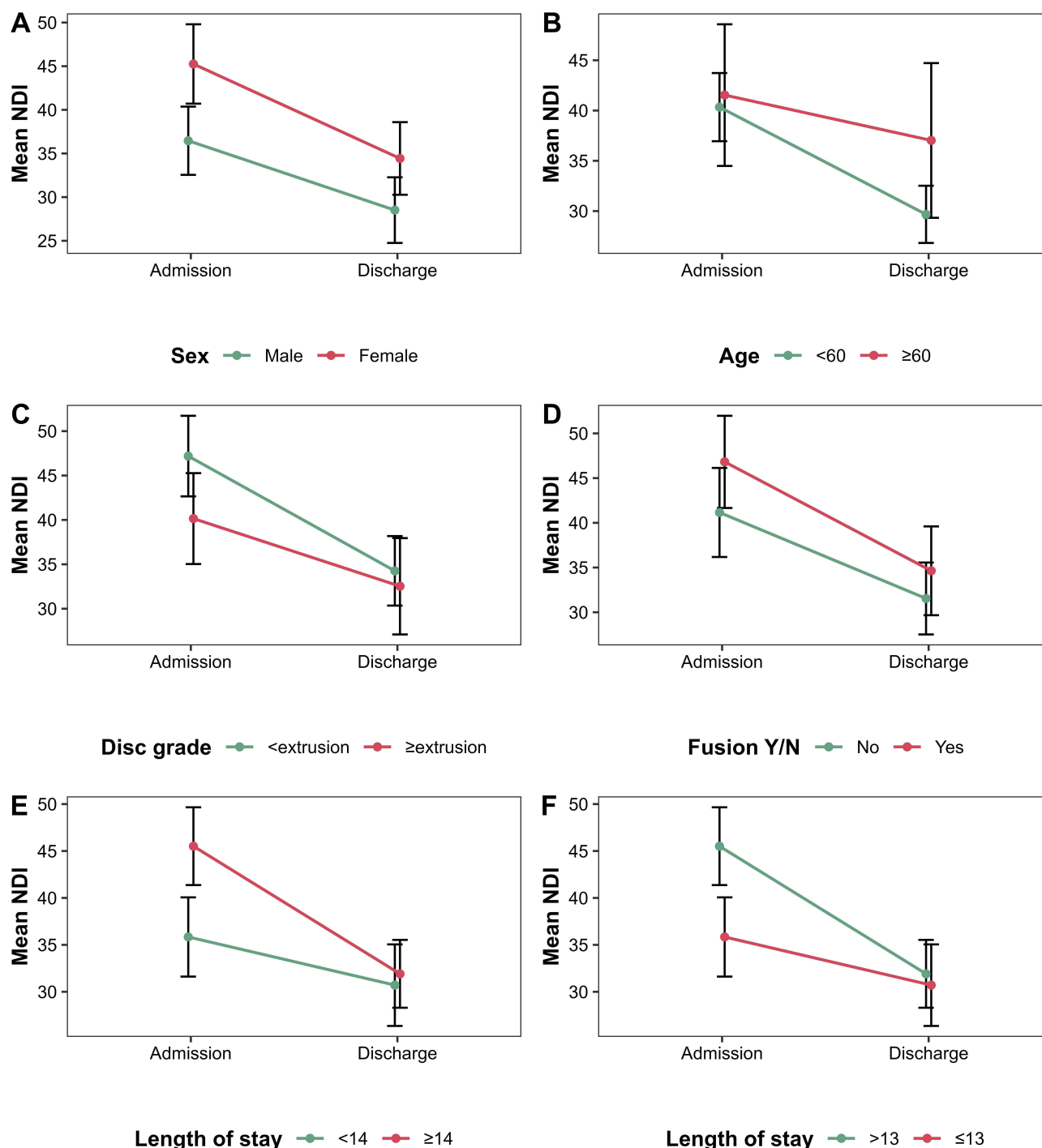


Figure 3 Difference in the change of NDI score based on (A) sex, (B) age, (C) disc herniation grade, (D) fusion surgery, and (E) length of hospital stay. **Abbreviation:** NDI, Neck Disability Index.

In this study, patients received integrative Korean medicine treatment, including acupuncture, electroacupuncture, pharmacopuncture, and Chuna manual therapy. Acupuncture is widely used for the relief of both acute and chronic pain,^{49,50} and electroacupuncture, in particular, is reported to modulate pain pathways by stimulating the sensory nervous system and immuno-inflammatory responses, and by promoting the release of endogenous analgesic substances such as opioids⁵¹ These mechanisms may have contributed to alleviating sequelae such as cervical pain and radiating arm pain, which are commonly observed after cervical disc surgery.³⁰

Table 4 Logistic Regression Analysis of Changes Above Minimal Clinically Important Difference

		NRS of NP	NDI
		OR (95% CI)	OR (95% CI)
Sex (ref: male)	Female	0.64 (0.24 to 1.70)	2.51 (0.98 to 6.42)
Age (ref: < 60)	≥ 60	1.06 (0.34 to 3.34)	0.61 (0.19 to 1.89)
Length of hospital stay (ref: <13 days)	≥ 14	4.73 (1.79 to 12.47)	3.60 (1.46 to 8.91)
Disc herniation grade (ref: <extrusion)	≥ extrusion	1.47 (0.57 to 3.81)	0.63 (0.25 to 1.56)
Fusion surgery (ref: No)	Yes	3.36 (1.26 to 8.97)	0.93 (0.38 to 2.32)
Area under the curve		0.75	0.73

Abbreviations: NRS, Numeric Rating Scale; NP, Neck pain; NDI, Neck Disability Index; OR, Odds ratio;

Although various herbal medicines were used, the most frequently administered formulations were those in the Cheongpajeon series, based on GCSB-5.⁵² GCSB-5 is composed of *Achyranthes bidentata* Blume, *Saposhnikovia divaricata* Schischkin, *Glycine max* Merrill, *Cibotium barometz* J. Smith, *Acanthopanax sessiliflorus* Seem, and *Eucommia ulmoides* Oliver. In both in vivo and in vitro studies, GCSB-5 has been shown to exert neuroprotective, chondroprotective, and anti-inflammatory effects.⁵³

Pharmacopuncture is a treatment that combines acupuncture point stimulation with the pharmacological effects of herbal medicine by injecting herbal extracts directly into acupuncture points or pain sites using disposable syringes.⁵⁴ In this study, the main types of pharmacopuncture used included Shinbaro2 pharmacopuncture, Hwangryunhaedoktang pharmacopuncture, and Danggwisusan pharmacopuncture. Shinbaro2 pharmacopuncture contains herbal ingredients with anti-inflammatory and chondroprotective effects, which help reduce inflammation and pain following disc injury.⁵⁵ Hwangryunhaedoktang pharmacopuncture suppresses inflammatory responses and promotes nerve recovery through its strong anti-inflammatory and detoxifying actions. Danggwisusan pharmacopuncture improves blood circulation and relieves muscle tension, thereby supporting postoperative recovery.⁵⁶

Chuna manual therapy is a treatment in which a Korean medicine doctor adjusts the musculoskeletal system using the hands or other parts of the body, aiming to improve joint alignment and relieve nerve compression. It is particularly effective in restoring cervical mobility and normalizing the function of muscles and ligaments.⁵⁷ In this study, 77% of patients received Chuna therapy, with no serious adverse events reported. These findings suggest that Chuna manual therapy is an effective and safe treatment option even for patients following cervical spine surgery.

From a traditional Korean medicine perspective, persistent neck pain can be interpreted as a form of *Bi* syndrome characterized by obstruction of qi and blood in the Taiyang–Shaoyang meridians of the neck.⁵⁸ Acupuncture (including electroacupuncture) was applied to regulate the Taiyang/Shao yang channels and promote qi–blood flow. Pharmacopuncture preparations used are traditionally employed to dispel wind-damp, clear heat and toxin, invigorate blood, and relax muscle tension. Chuna manual therapy corresponds to releasing soft-tissue and joint restrictions, which in traditional terms harmonizes qi and blood along the cervical meridians and helps normalize movement.

Some patients received manual therapy, transcutaneous electrical nerve stimulation, mechanical traction, and extracorporeal shockwave therapy in addition to Korean medicine interventions. The included hospitals in this study were collaborative institutions that offered both Korean and conventional medical care, with treatments administered as needed. When interpreting the results of this study, it is important to consider that some patients received these additional therapies. However, as most Korean medicine hospitals operate under a collaborative care system with conventional medicine and often incorporate physical therapy as part of routine care, the design of this study may more accurately reflect real-world clinical practice.

In this study, some patients also received conventional physical therapy modalities in addition to Korean medicine treatment; therefore, the observed outcomes should not be interpreted as the effects of Korean medicine alone. However, the proportion of patients who received physical therapy and the average number of sessions were relatively small, and thus this factor is unlikely to have substantially influenced the overall results. To the best of our knowledge, there are no previous studies that have evaluated the effects of physical therapy alone in this specific population, making direct comparisons between physical therapy and integrative Korean medicine treatment difficult.

This study has inherent limitations due to its retrospective design and the absence of a control group, which make it difficult to distinguish treatment effects from natural recovery. Furthermore, the study was not free from limitations such as the inability to control the consistency of interventions and potential confounding factors such as comorbidities. In addition, blinding of assessor, practitioners, and patients was not implemented. Second, the study focused on short-term treatment effects during hospitalization, and long-term outcomes such as recurrence, sustained benefit could not be assessed. Third, as this study was observational in nature, treatment modalities and durations were not controlled, and therefore the interventions cannot be fully replicated, resulting in limited consistency and reproducibility. Forth, owing to the retrospective design of this study, safety-related information could not be sufficiently identified from the medical records, and therefore adverse events were not systematically reported. Finally, it would have been valuable to evaluate disease patterns from a traditional medicine perspective.

Nevertheless, this study suggests that integrative Korean medicine treatment is a safe therapeutic approach associated with short-term improvements in patients who have undergone cervical disc surgery. Furthermore, the study holds value in that it utilized MRI findings to assess and compare the degree of disc herniation and the presence of fusion surgery. Randomized controlled trials remain warranted to clarify the causal relationship and verify its long-term effectiveness through extended follow-up.

Conclusion

This study suggests that integrative Korean medicine treatment was associated with short-term improvements in pain, functional disability, and quality of life among patients who had undergone cervical disc surgery in Korea. However, given the heterogeneous treatment modalities and the absence of a control group, the findings should be interpreted with caution. Further high-quality, controlled studies are warranted to confirm these results and assess their long-term applicability.

Abbreviations

MRI, magnetic resonance imaging; NRS, Numeric Rating Scale; NDI, Neck Disability Index; EQ-5D-5L, 5-level EuroQol 5-Dimension; PGIC, Patient Global Impression of Change; ROM, range of motion; CIs, confidence intervals.

Data Sharing Statement

The authors do not intend to share individual deidentified participant data publicly, as the datasets used in this study were obtained from patient medical records under institutional ethical approval and contain sensitive clinical information. Deidentified datasets may, however, be available from the corresponding author upon reasonable request and with permission from the Institutional Review Board of Jaseng Hospital of Korean Medicine. No additional study-related documents (such as the protocol or statistical analysis plan) will be made available. The data will be accessible upon publication of this article and for up to three years thereafter.

Ethics Statement

This study was approved by the Institutional Review Board of Jaseng Hospital of Korean Medicine (approval no.: JASENG 2023-09-043; approval date: September 27, 2023), and informed consent was waived due to the retrospective nature of the study. It was conducted in accordance with the Declaration of Helsinki and confirmed to STROBE guidelines.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Abbed KM, Coumans J-VC. Cervical radiculopathy: pathophysiology, presentation, and clinical evaluation. *Neurosurgery*. 2007;60(1):S1–28. doi:10.1227/01.NEU.0000249223.51871.C2
2. Abdulkarim J, Dhingra R, Finlay D. Magnetic resonance imaging of the cervical spine: frequency of degenerative changes in the intervertebral disc with relation to age. *Clin Radiol*. 2003;58(12):980–984. doi:10.1016/S0009-9260(03)00255-1
3. Saal JS, Saal JA, Yurth EF. Nonoperative management of herniated cervical intervertebral disc with radiculopathy. *Spine*. 1996;21(16):1877–1883. doi:10.1097/00007632-199608150-00008
4. Benzel EC, Connolly PJ. *The Cervical Spine*. Lippincott Williams & Wilkins; 2012.
5. Kato S, Fehlings M. Degenerative cervical myelopathy. *Curr Rev Musculoskelet Med*. 2016;9:263–271. doi:10.1007/s12178-016-9348-5
6. Bydon M, Mathios D, Macki M, et al. Long-term patient outcomes after posterior cervical foraminotomy: an analysis of 151 cases. *J Neurosurg Spine*. 2014;21(5):727–731. doi:10.3171/2014.7.SPINE131110
7. Liu CY, Zygorakis CC, Yoon S, et al. Trends in utilization and cost of cervical spine surgery using the National Inpatient Sample Database, 2001 to 2013. *Spine*. 2017;42(15):E906–E913. doi:10.1097/BRS.0000000000001999
8. Tetreault L, Ibrahim A, Côté P, Singh A, Fehlings MG. A systematic review of clinical and surgical predictors of complications following surgery for degenerative cervical myelopathy. *J Neurosurg Spine*. 2016;24(1):77–99. doi:10.3171/2015.3.SPINE14971
9. Mesregah MK, Formanek B, Liu JC, Buser Z, Wang JC. Perioperative complications of surgery for degenerative cervical myelopathy: a comparison between 3 procedures. *Global Spine J*. 2023;13(2):432–442. doi:10.1177/2192568221998306
10. Hillard VH, Apfelbaum RI. Surgical management of cervical myelopathy: indications and techniques for multilevel cervical discectomy. *Spine J*. 2006;6(6):S242–S251.
11. Machino M, Yukawa Y, Hida T, et al. Modified double-door laminoplasty in managing multilevel cervical spondylotic myelopathy: surgical outcome in 520 patients and technique description. *Clin Spine Surg*. 2013;26(3):135–140.
12. Helgeson MD, Albert TJ. Surgery for failed cervical spine reconstruction. *Spine*. 2012;37(5):E323–E327. doi:10.1097/BRS.0b013e31823ec9d2
13. McCormack RA, Hunter T, Ramos N, Michels R, Hutzler L, Bosco JA. An analysis of causes of readmission after spine surgery. *Spine*. 2012;37(14):1260–1266. doi:10.1097/BRS.0b013e318245f561
14. North RB, Kidd DH, Zahurak M, James CS, Long DM. Spinal cord stimulation for chronic, intractable pain: experience over two decades. *Neurosurgery*. 1993;32(3):384–395. doi:10.1227/00006123-199303000-00008
15. Thomson S. Failed back surgery syndrome - definition, epidemiology and demographics. *Br J Pain*. 2013;7(1):56–59. doi:10.1177/2049463713479096
16. Daniell JR, Osti OL. Failed back surgery syndrome: a review article. *Asian Spine J*. 2018;12(2):372. doi:10.4184/asj.2018.12.2.372
17. Karpova A, Arun R, Davis AM, et al. Predictors of surgical outcome in cervical spondylotic myelopathy. *Spine*. 2013;38(5):392–400.
18. Park SJ, Kim SB, Kim MK, Lee SH, Oh IH. Clinical features and surgical results of cervical myelopathy caused by soft disc herniation. *Korean J Spine*. 2013;10(3):138. doi:10.14245/kjs.2013.10.3.138
19. Hermansen A, Hedlund R, Zsigmond P, Peolsson A. A more than 20-year follow-up of pain and disability after anterior cervical decompression and fusion surgery for degenerative disc disease and comparisons between two surgical techniques. *BMC Musculoskelet Disord*. 2023;24(1):406. doi:10.1186/s12891-023-06503-w
20. Sasso WR, Ye J, Foley DP, Vinayek S, Sasso RC. 20-year clinical outcomes of cervical disk arthroplasty: a prospective, randomized, controlled trial. *Spine*. 2024;49(1):1–6. doi:10.1097/brs.00000000000004811
21. Lim B. Korean medicine coverage in the National Health Insurance in Korea: present situation and critical issues. *Integrat Med Res*. 2013;2(3):81–88. doi:10.1016/j.imr.2013.06.004
22. Wu M-S, Chen K-H, Chen I-F, et al. The efficacy of acupuncture in post-operative pain management: a systematic review and meta-analysis. *PLoS One*. 2016;11(3):e0150367. doi:10.1371/journal.pone.0150367
23. Lee J, Shin J-S, Lee YJ, et al. Long-term Course of Failed Back Surgery Syndrome (FBSS) patients receiving integrative Korean medicine treatment: a 1 year prospective observational multicenter study. *PLoS One*. 2017;12(1):e0170972. doi:10.1371/journal.pone.0170972
24. Cho YH, Kim CK, Heo KH, et al. Acupuncture for acute postoperative pain after back surgery: a systematic review and meta-analysis of randomized controlled trials. *Pain Pract*. 2015;15(3):279–291. doi:10.1111/papr.12208
25. Shin D, Shin K, Jeong H, et al. Effectiveness of electroacupuncture for patients with failed back surgery syndrome: a systematic review and meta-analysis; 2022.
26. Hong H, An SK, Lee T, Kim J, Kim E. Short-term effects of combined Korean medicine treatment including acupotomy in a patient with failed back surgery syndrome: a case report; 2025.
27. Jeong S, Lee J. A case report on HIVD-cervical spine failed back surgery syndrome applied Chuna treatment. *Korean Society Chuna Manual Med Spine Nerves*. 2011;6(1):105–111.
28. Lee J-Y, Shin W-B, Lim S-Y, Moon Y-J, Jeon H-A, H-w N. A case report of spine decompression including Korean medical treatments on post-operative state of cervical spine. *J Chuna Manual Med Spine Nerves*. 2019;14(2):113–122.
29. Jo D-C. The case report of Korean medical treatment including chuna on post-operative state of cervical spine. *J Korean Med Rehabil*. 2019;29(1):85–90. doi:10.18325/jkmr.2019.29.1.85
30. Lee T, Kim J, An SK, et al. Integrative Korean medicine treatment for pain after anterior cervical discectomy and fusion: a case report. *J Acupuncture Res*. 2024;41:191–196. doi:10.13045/jar.24.0009
31. Kim D, Baek GG, Shin B-C. An umbrella review of systematic reviews for Chuna (or Tuina) manual therapy on musculoskeletal disorders. *Perspect Integrat Med*. 2023;2(3):142–154. doi:10.56986/pim.2023.10.002
32. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: visual analog scale for pain (VAS Pain), numeric rating scale for pain (NRS Pain), mcgill pain questionnaire (MPQ), short-form mcgill pain questionnaire (SF-MPQ), chronic pain grade scale (CPGS), short form-36 bodily pain scale (SF-36 BPS), and measure of intermittent and constant osteoarthritis pain (ICOAP). *Arthritis Care Res*. 2011;63(S11):S240–S252.

33. Sterling M, Rebbeck T. The neck disability index (NDI). *Aust J Physiother.* 2005;51(4):271. doi:10.1016/S0004-9514(05)70017-9
34. Kim S-H, Ahn J, Ock M, et al. The EQ-5D-5L valuation study in Korea. *Qual Life Res.* 2016;25:1845–1852. doi:10.1007/s11136-015-1205-2
35. Swinkels RA, Swinkels-Meewisse IE. Normal values for cervical range of motion. *Spine.* 2014;39(5):362–367. doi:10.1097/BRS.0000000000000158
36. Young BA, Walker MJ, Strunce JB, Boyles RE, Whitman JM, Childs JD. Responsiveness of the Neck Disability Index in patients with mechanical neck disorders. *Spine J.* 2009;9(10):802–808. doi:10.1016/j.spinee.2009.06.002
37. Bahreini M, Safaie A, Mirfazaelian H, Jalili M. How much change in pain score does really matter to patients? *Am J Emergency Med.* 2020;38(8):1641–1646.
38. Cleland JA, Childs JD, Whitman JM. Psychometric properties of the neck disability index and numeric pain rating scale in patients with mechanical neck pain. *Arch Phys Med Rehabil.* 2008;89(1):69–74.
39. Kovacs FM, Abaira V, Royuela A, et al. Minimum detectable and minimal clinically important changes for pain in patients with nonspecific neck pain. *BMC Musculoskelet Disord.* 2008;9:1–9. doi:10.1186/1471-2474-9-43
40. Young IA, Dunning J, Butts R, Cleland JA, Fernández-de-las-peñas C. Psychometric properties of the numeric pain rating scale and neck disability index in patients with cervicogenic headache. *Cephalalgia.* 2019;39(1):44–51. doi:10.1177/0333102418772584
41. Lynch CP, Cha ED, Jenkins NW, et al. The minimum clinically important difference for patient health questionnaire-9 in minimally invasive transforaminal interbody fusion. *Spine.* 2021;46(9):603–609. doi:10.1097/BRS.0000000000003853
42. Meyer-Rosberg K, Burckhardt CS, Huizar K, Kvarnström A, Nordfors L-O, Kristofferson A. A comparison of the SF-36 and Nottingham Health Profile in patients with chronic neuropathic pain. *Eur J Pain.* 2001;5(4):391–403. doi:10.1053/eujp.2001.0260
43. Calvert MJ, Freemantle N, Cleland JG. The impact of chronic heart failure on health-related quality of life data acquired in the baseline phase of the CARE-HF study. *Eur J Heart Failure.* 2005;7(2):243–251. doi:10.1016/j.ejheart.2005.01.012
44. Jensen MP, Chodroff MJ, Dworkin RH. The impact of neuropathic pain on health-related quality of life: review and implications. *Neurology.* 2007;68(15):1178–1182. doi:10.1212/01.wnl.0000259085.61898.9e
45. Parker SL, Godil SS, Shau DN, Mendenhall SK, McGirt MJ. Assessment of the minimum clinically important difference in pain, disability, and quality of life after anterior cervical discectomy and fusion. *J Neurosurg Spine.* 2013;18(2):154–160. doi:10.3171/2012.10.SPINE12312
46. Kato S, Oshima Y, Matsubayashi Y, Taniguchi Y, Tanaka S, Takeshita K. Minimum clinically important difference in outcome scores among patients undergoing cervical laminoplasty. *Eur Spine J.* 2019;28:1234–1241.
47. Baek SH, Oh JW, Shin J-S, et al. Long term follow-up of cervical intervertebral disc herniation inpatients treated with integrated complementary and alternative medicine: a prospective case series observational study. *BMC Complementary Alternative Med.* 2015;16:1–13. doi:10.1186/s12906-016-1034-z
48. Sasso WR, Ye J, Foley DP, Vinayek S, Sasso RC. 20-year clinical outcomes of cervical disk arthroplasty: a prospective, randomized, controlled trial. *LWW.* 2024.
49. Lee J-H, Choi T-Y, Lee MS, Lee H, Shin B-C, Lee H. Acupuncture for acute low back pain: a systematic review. *Clin J Pain.* 2013;29(2):172–185. doi:10.1097/AJP.0b013e31824909f9
50. Lin J-G, Chen W-L. Acupuncture analgesia: a review of its mechanisms of actions. *Am J Chin Med.* 2008;36(04):635–645. doi:10.1142/S0192415X08006107
51. Zhang R, Lao L, Ren K, Berman BM. Mechanisms of acupuncture-electroacupuncture on persistent pain. *Anesthesiology.* 2014;120(2):482. doi:10.1097/ALN.0000000000000101
52. Park JJ, Shin J, Choi Y, et al. Integrative package for low back pain with leg pain in Korea: a prospective cohort study. *Complementary Ther Med.* 2010;18(2):78–86. doi:10.1016/j.ctim.2010.02.003
53. Chung H-J, Lee H-S, Shin J-S, et al. Modulation of acute and chronic inflammatory processes by a traditional medicine preparation GCSB-5 both in vitro and in vivo animal models. *J Ethnopharmacol.* 2010;130(3):450–459. doi:10.1016/j.jep.2010.05.020
54. M-r K, Lee SM, Lee YJ, Ha I-H. Clinical research on pharmacopuncture in Korea: a scoping review. *Perspect Integrat Med.* 2023;2(1):8–23. doi:10.56986/pim.2023.02.003
55. Kim WK, Shin J-S, Lee J, et al. Effects of the administration of Shinbaro 2 in a rat lumbar disk herniation model. *Front Neurol.* 2023;14:1044724. doi:10.3389/fneur.2023.1044724
56. Kim M-C, Lee C-H, Yook T-H. Effects of anti-inflammatory and Rehmanniae radix pharmacopuncture on atopic dermatitis in NC/Nga mice. *J Acupuncture Meridian Studies.* 2013;6(2):98–109. doi:10.1016/j.jams.2012.10.007
57. Do HJ, Shin J-S, Lee J, et al. Comparative effectiveness and economic evaluation of Chuna manual therapy for chronic neck pain: protocol for a multicenter randomized controlled trial. *Trials.* 2018;19:1–11. doi:10.1186/s13063-018-3016-6
58. Jiang S. Observation on the effectiveness and prognosis of traditional chinese medicine syndrome differentiation Treatment for Bi Syndrome. *MEDS Chin Med.* 2023;5(5):57–64.

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