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EARLY NEUROLOGICAL RECOVERY AFTER ANTERIOR CERVICAL DISCECTOMY WITH CAGE FUSION

RANI NEUROLOŠKI OPORAVAK NAKON PREDNJE CERVIKALNE DISKEKTOMIJE SA KEJDŽ-FUZIJOM

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Abstract

Introduction. Anterior cervical discectomy and fusion is the standard surgical treatment for cervical discopathy and myelopathy caused by degenerative disc disease and osteophyte formation. The primary goal of the procedure is decompression of neural structures within the spinal canal by removing compressive pathology. Although neurological recovery after the procedure has been widely studied, data on neurological status in the immediate postoperative period remain limited. This retrospective study analyzed the association between clinical and radiological characteristics and early postoperative neurological recovery following the surgery. **Material and Methods.** The study included 66 patients who underwent the procedure at the Clinical Center of Vojvodina between 2022 and 2023. Statistical analysis using the χ^2 test and Fisher's exact test ($p<0.05$) evaluated the influence of neurological deficit type, number of operated levels, presence of spondylosis, and type of disc pathology on early postoperative neurological outcome. **Results.** Overall neurological improvement was observed in 82.5% of patients, with 42.8% showing significant improvement and 39.7% mild improvement. Statistically significant difference in early neurological recovery was found between single-level and two-level procedures ($p=0.005$), as well as between patients with disc protrusion and those with disc extrusion ($p=0.035$). No significant association was identified between early neurological recovery and neurological deficit type or the presence of spondylosis. **Conclusion.** Disc protrusion and a lower number of operated levels are positive predictors of early neurological improvement after the procedure, whereas spondylosis and neurological deficit type do not significantly affect early outcomes. Early postoperative neurological assessment may provide valuable insight into overall functional recovery.

Key words: Neurological Rehabilitation; Diskectomy; Cervical Vertebrae; Spinal Fusion; Intervertebral Disc Displacement; Spondylosis; Decompression, Surgical; Recovery of Function

Sažetak

Uvod. Prednja cervikalna diskektomija i fuzija predstavlja standardni hirurški postupak u lečenju cervikalnih diskopatija i mijelopatija uzrokovanih degenerativnim promenama diska i osteofitima. Njena osnovna uloga je da izvrši dekompresiju nervnih struktura kičmenog kanala uklanjanjem tkiva koje ih komprimuje. Iako je prisutan veliki broj radova koji prate neurološki oporavak pacijenata nakon ove procedure, nema studija koje su se fokusirale na neurološki status operisanih u najranijem postoperativnom periodu, te je cilj ove retrospektivne studije bio da ispita povezanost kliničkih i radioloških karakteristika pacijenata sa ranim postoperativnim neurološkim oporavkom nakon ove procedure. **Materijal i metode.** Analizirano je 66 pacijenata operisanih u Kliničkom centru Vojvodine tokom 2022-2023. godine. Statističkom analizom (χ^2 test, Fišerov tačan test, $p < 0,05$) ispitivan je uticaj tipa neurološkog ispada, broja operisanih nivoa, prisustva spondiloze i tipa oštećenja diska na rani postoperativni neurološki ishod. **Rezultati.** U našoj studiji je 82,5% pacijenata ostvarilo poboljšanje neurološkog statusa (42,8% značajno, 39,7% blago). Nađena je statistički značajna razlika između broja pacijenata koji su postigli rani neurološki oporavak kada je procedura urađena na jednom nivou u odnosu na dva nivoa ($p = 0,005$), kao i između onih sa protruzijom u poređenju sa ekstruzijom diska ($p = 0,035$). Nije utvrđen značajan uticaj tipa neurološkog ispada niti prisustva spondiloze na rani neurološki oporavak. **Zaključak.** Protruzija diska i manji broj operisanih nivoa su pozitivni prediktori ranog neurološkog poboljšanja nakon navedene procedure, dok spondiloza i tip neurološkog deficita ne utiču značajno na ishod. Praćenje ranog postoperativnog perioda ima klinički značaj jer može doprineti predviđanju ukupnog funkcionalnog oporavka pacijenata.

Ključne reči: neurološka rehabilitacija; diskektomija; vratni pršljenovi; spinalna fuzija; protruzija diska; spondiloza; hirurška dekompresija; oporavak funkcije

Introduction

Anterior cervical discectomy and fusion (ACDF) is among the most frequently performed procedures in cervical spine surgery [1]. The primary indications for ACDF include cervical intervertebral disc herniation and osteophyte formation at the intervertebral level. In both conditions, progressive degenerative changes lead to a reduction in cervical spinal canal volume, resulting in compression of the spinal cord and spinal nerve roots [1–3]. Consequently, patients may develop neurological syndromes such as cervical radiculopathy and degen-

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Abbreviations

ACDF	– anterior cervical discectomy and fusion
CNS	– central nervous system
MRI	– magnetic resonance imaging
PEEK	– polyetheretherketone
P25	– 25th percentile
P75	– 75th percentile
χ^2	– chi-square test

erative cervical myelopathy, clinically manifested by neck and upper extremity pain, numbness, impaired coordination, and sphincter control issues [4,5]. Definitive treatment of these conditions requires surgical decompression of the spinal canal through removal of the compressive pathology, followed by restoration of segmental stability – principles that constitute the foundation of ACDF [1,6]. During the procedure, the intervertebral disc and associated osteophytes are excited, and the resulting intervertebral space is reconstructed using a prefabricated cage or bone graft, thereby achieving stabilization of the affected cervical segment [6–8]. Additional anterior plate fixation may be employed depending on surgeon preference and biomechanical requirements [6]. Postoperative management typically involves early mobilization and kinesitherapy with temporary cervical orthosis support until radiographic evidence of intervertebral fusion is obtained, after which the orthosis is discontinued and rehabilitation intensified [9]. Despite the development of motion-preserving alternatives, such as cervical disc arthroplasty, and minimally invasive techniques, including endoscopic decompression and discectomy, ACDF continues to be regarded as the "gold standard" for the surgical management of cervical disc disease due to its reliability and favorable long-term outcomes [10,11]. However, successful postoperative stability and prevention are strongly influenced by the quality of intervertebral fixation and fusion [12]. To achieve this, various grafting options have been employed, including autologous bone graft, allografts, and synthetic interbody cages [13,14]. Each approach presents specific advantages and limitations. Autologous bone grafts – most commonly harvested from the iliac crest – are associated with donor-site morbidity such as hematoma, seroma, infection, and in rare cases, iliac fracture, hemorrhage, or herniation of abdominal contents [13,15]. Allografts, while avoiding donor-site complications, carry a potential risk of disease transmission. As a result, contemporary surgical practice increasingly favors synthetic cages, which eliminate donor-site morbidity [16].

Currently, interbody cages are most commonly manufactured from polyetheretherketone (PEEK), carbon fiber, or titanium [13]. These materials allow combination with osteoconductive and osteoinductive adjuncts, including bone shavings from osteophytes, bone marrow aspirate, platelet-rich plasma, or bone morphogenetic proteins, thereby facilitating osseous integration and fusion [17–19]. Advances in cage design and biomedical technology have significantly improved ACDF outcomes over recent decades by reducing complication rates and enhancing cervical spine biomechanics [20,21]. Nevertheless, although numerous studies have evaluated long-term neurological outcomes and complication profiles following ACDF, the early postoperative neurological recovery period – prior to the initiation of formal rehabilitation – remains insufficiently investigated. Emerging evidence suggests that early neurological improvement is not merely a transient phenomenon but may correlate with long-term functional and neurological outcomes after spinal decompression procedures [22]. Therefore, early postoperative neurological status may represent an important prognostic indicator, reflecting the immediate effectiveness of neural decompression and the residual capacity for neurological recovery. Moreover, many studies assessing postoperative outcomes following cervical spine surgery do not adequately consider the influence of individual patient and pathology-related characteristics. Factors such as the presence of degenerative cervical changes, the number of operated levels, and the type or severity of disc pathology may significantly affect postoperative recovery. This consideration is particularly relevant given that chronic compressive injury to the spinal cord and nerve roots results in axonal damage, and axonal regeneration within the central nervous system (CNS) is limited [23–25].

The aim of this study was to investigate the relationship between selected patient and disease-related characteristics and early postoperative neurological recovery following ACDF. Based on previous studies examining neurological outcomes after ACDF [26–28] and our clinical experience, we analyzed the following parameters as potential predictors of early neurological recovery:

- type of preoperative neurological deficit,
- number of operated cervical levels,
- presence of cervical spondylosis,
- type of intervertebral disc lesion.

Material and Methods

This study was designed as a retrospective observational analysis using data obtained from the Clinical Information System of the Clinical Center of Vojvodina. The study population comprised 66 patients who underwent ACDF at the Clinic for Neurosurgery, Clinical Center of Vojvodina, between January 1, 2022, and December 31, 2023. The study protocol was approved by the Ethics Committee of the Clinical Center of Vojvodina.

Data were collected from patients' medical records, including preoperative and postoperative neurosurgical assessments, radiological imaging (X-ray and MRI), operative reports, discharge summaries, and available documentation from institutions where inpatient rehabilitation was conducted. In cases where specific documentation was unavailable, patients were excluded only from statistical analyses requiring the missing data; such exclusions are specified in the Results section. Radiological findings were interpreted according to official radiology reports. When detailed radiological descriptions were unavailable, the presence of degenerative cervical spine changes (cervical spondylosis) was determined based on established diagnostic criteria described in the literature [29].

The observation period for evaluating postoperative neurological changes was defined as the interval from immediately after surgery until the initiation of formal rehabilitation. This approach was chosen to minimize the influence of physical therapy and biological remyelination process on neurological recovery. Remyelination of chronically compressed spinal nerve roots may take up to eight weeks [30], which exceeds the typical timeframe before rehabilitation begins. Accordingly, this observation window was intended to isolate the direct effect of surgical decompression, primarily reflecting the removal of functional axonal conduction block.

Early neurological recovery was defined as any improvement in neurological status compared with the preoperative condition within this timeframe. Neurological status was assessed by comparing preoperative findings with postoperative neurological descriptions documented in neurosurgical discharge summaries and initial rehabilitation assessments. Based on these evaluations, postoperative neurological outcomes were categorized as follows:

– Significant improvement: complete resolution or marked reduction of neurological signs and symptoms, confirmed by concordance between patient self-report and objective neurological examination;

– Mild improvement: partial symptom regression or reduced symptom intensity, typically reported subjectively by the patient and accompanied by minor or inconsistent objective neurological changes;

– No significant improvement: absence of measurable neurological change compared with the preoperative status.

These outcome categories were subsequently used for statistical analyses.

Data were presented as mean ± standard deviation, median with interquartile range (P25–P75), or absolute and relative frequencies, depending on data distribution and variable type. Descriptive statistics included patient sex and age, presenting symptoms, type of preoperative neurological deficit (radiculopathy or myelopathy), presence of cervical spondylosis, number of operated levels (single-level or two-level ACDF), distribution of disc pathology by cervical level, time from hospital discharge to initiation of rehabilitation, and early postoperative neurological outcome.

Comparative analyses were performed to evaluate associations between early neurological recovery and selected clinical and radiological parameters. Early recovery (mild or significant improvement) was compared between the following subgroups:

– radiculopathy vs. myelopathy;
– single-level vs. two-level ACDF;
– presence vs. absence of cervical spondylosis;
– disc protrusion vs. disc extrusion.

Categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. Additionally, the association between the number of operated levels and postoperative complications was assessed by comparing complication rates between single- and two-level ACDF groups using the Chi-square test. All statistical analyses were performed using SPSS Statistics 23 (IBM Corp., Armonk, NY, USA). A value of $p<0.05$ was considered statistically significant.

Results

A total of 66 patients were included in the study, comprising 35 men (53%) and 31 women (47%). The mean patient age was 52.20 ± 11.84 years (range: 23-79 years) **(Table 1).**

The most frequently reported presenting symptoms were neck pain (32 patients), bilateral upper limb weakness (29 patients), bilateral upper limb numbness (25 patients), and unilateral upper limb tingling (21 patients), with an almost equal distribution between the right and left sides (11 vs. 10 patients). Less common symptoms included concurrent upper limb weakness and pain (15 patients each), gait disturbance (11 patients), and lower limb tingling (9 patients). Isolated lower limb weakness was reported by 21 patients. Other symptoms - such as headache, dizziness, sphincter dysfunction, hand or foot spasms, and unilateral sensory or motor deficits of the lower extremities - were present in 7 patients.

Preoperative neurological assessment revealed isolated cervical radiculopathy in 21 patients (32%), cervical myelopathy in 25 patients (40%), and combined radiculopathy and myelopathy in 19 patients (29.2%). There was no statistically significant difference between the number of patients with isolated radiculopathy and those with isolated myelopathy ($\chi^2 = 0.348$; df = 1; p = 0.555). One patient was excluded

Table 1. Basic demographic characteristics of patients (N=66); preoperative neurological deficit type (N=65); radiographic findings of cervical spine spondylosis (N=60)

Age (years), Mean ± SD	52.20±11.84
Sex, Male/Female n (%)	35 (53)/31 (47)
Neurological deficit type (N=65)	
Radiculopathy, n (%)	21 (32.3)
Myelopathy, n (%)	25 (38.5)
Concurrent neurological deficits; n (%)	19 (29.2)
Single-level disc damage	47 (71.2)
Two-level disc damage	19 (28.8)
Radiological finding of spondylosis in adjacent vertebrae (N=60), n (%)	
Severe	37 (61.7%)
Mild	12 (20%)
No spondylosis	11 (18.3%)

N – sample size (number of patients); SD – standard deviation

from further neurological analysis because surgery was indicated solely on MRI findings of a disc extrusion, with headache as the only symptom and no documented neurological deficit (final n = 65).

Perioperative radiological documentation (X-ray and/or MRI) was available for 60 patients; imaging data were unavailable for 6 patients. These cases were excluded only from analyses requiring radiological variables. No systematic differences in clinical characteristics were observed between patients with complete and incomplete imaging data.

Radiographically evident degenerative cervical spine changes were present in 37 patients (61.7%), while mild degenerative changes were observed in 12 patients (20%), and no degenerative changes in 11 patients (18.3%). The prevalence of radiographically confirmed spondylosis was significantly higher compared to mild or absent degenerative changes (χ^2 = 18.333; df = 1; p = 0.000; χ^2 = 21.324; df = 1; p = 0.000).

Single-level ACDF was performed in 47 patients (71.2%), whereas 19 patients (28.8%) underwent two-level ACDF. Patients who underwent three–level ACDF were not analyzed separately due to their very small number during the study period, which precluded meaningful statistical comparison. Inclusion of three-level procedures in the two-level group was deliberately avoided to preserve group homogeneity with respect to surgical extent and biomechanical considerations.

Among single-level procedures, disc protrusion/extrusion was most commonly located at the C5–C6 level (19/47; 40.4%). In the two-level group, adjacent disc involvement was observed in nearly all cases (18/19; 94.7%), with disc herniation most frequently located at C5–C6 and C6–C7 levels.

Postoperative rehabilitation data were available for 26 patients. Half of these patients initiated inpatient rehabilitation within 15 days following discharge from the neurosurgery clinic, while 7 patients (26.9%) began rehabilitation more than 30 days after discharge. The median duration of rehabilitation was 21 days (range: 14–21), indicating that approximately one-quarter of patients underwent rehabilitation lasting three weeks **(Table 2).**

Due to incomplete documentation, two patients were excluded from the neurological outcome analysis, was along with one patient without preoperative neurological deficit, resulting in a final sample size of 63 patients.

Significant neurological improvement was observed in 27 patients (42.8%), mild improvement in 25 patients (39.7%), and no meaningful improvement in 11 patients (17.5%). The proportion of patients without neurological improvement was significantly

Table 2. Description of early postoperative neurological status; period from discharge to the initiation of inpatient rehabilitation and duration thereof

Postoperative neurological status (N=63)	
No significant improvement	11 (17.5)
Mild improvement	25 (39.7)
Significant improvement	27 (42.8)
Initiation of rehabilitation (days after surgery); Median (P25–P75)	14 (10-30)
Duration of rehabilitation; Median (P25–P75)	21 (14-21)

N – sample size (number of patients); SD – standard deviation; P25 – 25th percentile; P75 – 75th percentile

Table 3. Effect of the analyzed parameters on early postoperative neurological recovery; n (%)

	No improvement (n=11) [a]	Mild improvement (n=25) [b]	Significant improvement (n=27) [c]	Significance[#]
Type of isolated preoperative neurological deficit (N=45):				
Radiculopathy, (n=21)	3 (14.3)	11 (52.4)	7 (33.3)	b/a***; c/a**,#
Myelopathy, (n=24)	5 (20.8)	11 (45.8)	8 (33.4)	c/a***; b/a*,#
Single-level disc damage	9 (20)	15 (33.3)	21 (46.7)	c/a***,#
Two-level disc damage	3 (15.8)	10 (52.6)	6 (31.6)	b/a***; c/a*,#
Spondylosis of adjacent vertebrae				
With spondylosis	10 (27.8)	13 (36.1)	13 (36.1)	ns#
Mild spondylosis	-	6 (50)	6 (50)	ns#
No spondylosis	1 (9.1)	4 (36.4)	6 (54.5)	b,c/a***,#
Radiological finding of single-level disc damage				
Extrusion	7 (18.4)	12 (31.6)	19 (50)	c/a***; c/b*,#
Protrusion	1 (16.7)	3 (50)	2 (33.3)	b/a***; c/a*,#
Radiological finding of two-level disc damage – upper disc				
Extrusion	3 (27.3)	5 (45.4)	3 (27.3)	b/a,c*,#
Protrusion	-	5 (62.5)	3 (37.5)	b/c**,#
Radiological finding of two-level disc damage – lower disc				
Extrusion	3 (25)	6 (50)	3 (25)	b/a,c**,#
Protrusion	-	4 (57.1)	3 (42.9)	ns#

Chi-square test and Fisher's exact test; *p<0.05; **p<0.01; ***p<0.001; ns – not statistically significant

lower compared with those who achieved significant improvement ($\chi^2 = 8.719$; df = 1; p = 0.003) or mild improvement ($\chi^2 = 6.918$; df = 1; p = 0.008) **(Table 2).**

Influence of Neurological Deficit Type

Only patients with a single preoperative neurological deficit (radiculopathy or myelopathy) were included in this analysis (n = 45). Among patients with radiculopathy (n = 21), 3 (14.3%) showed no improvement, 11 (52.4%) mild improvement, and 7 (33.3%) significant improvement. Among patients with myelopathy (n = 24), 5 (20.8%) showed no improvement, 11 (45.8%) mild improvement, and 8 (33.4%) significant improvement. Although both groups demonstrated a significantly higher proportion of improved compared with unimproved patients, no statistically significant difference in recovery distribution was observed between radiculopathy and myelopathy groups ($\chi^2 = 0.1895$; df = 1; p = 0.6637) **(Table 3).**

Influence of Number of Operated Levels

Among patients undergoing single-level ACDF (n = 45), significant improvement was observed in 21 patients (46.7%), mild improvement in 15 patients (33.3%), and no improvement in 9 patients (20%). In the two-level ACDF group (n = 19), 6 patients (31.6%) achieved significant improvement, 10 (52.6%) mild improvement, and 3 (15.8%) showed no improvement. A statistically significant association was found between the number of operated levels and early postoperative neurological recovery ($\chi^2 = 10.526$; df = 2; p = 0.005) **(Table 3).**

Influence of Cervical Spondylosis

Among patients with radiographically confirmed cervical spondylosis (n = 36), significant neurological recovery occurred in 13 patients (36.1%), mild improvement in 13 patients (36.1%), and no improvement in 10 patients (27.8%) **(Table 3).** Although postoperative improvement was statistically significant in patients without spondylosis, no significant correlation was identified between the presence or severity of cervical spondylosis and the degree of early neurological recovery ($\chi^2 = 4.663$; df = 4; p = 0.097).

Influence of Disc Lesion Type

The distribution of disc protrusion and extrusion is presented in **Table 3**. In all two-level ACDF cases, both operated discs demonstrated the same lesion type. In both single- and two-level ACDF groups, improved neurological outcomes were significantly more frequent than absence of improvement **(Table 3).** A statistically significant difference in early postoperative neurological recovery was observed between patients with disc protrusion and those with disc extrusion, with better outcomes of the protrusion group ($\chi^2 = 6.674$; df = 2; p = 0.035).

Discussion

The introduction of PEEK cages for ACDF has led to substantial improvements in postoperative outcomes, both by enhancing segmental stability and by reducing procedure-related complications [13,15]. Traditional bone grafts, which were once the predominant material used in ACDF, were susceptible to dislocation due to their flat contact surfaces and often required supplementary anterior plate fixation. This additional hardware increased the risk of intraoperative and delayed complications [31,32]. In contrast, PEEK cages are distinguished with irregular, serrated surfaces that reduce the likelihood of dislocation and minimize the need for additional fixation [32]. Consequently, ACDF using cage-based techniques is now regarded as a relatively safe procedure. Nevertheless, this does not diminish the importance of identifying patient- and pathology-related risk factors that may influence surgical outcomes.

The present study focused specifically on the early postoperative period following ACDF, defined as the interval from surgery to the initiation of inpatient rehabilitation (median: 21 days). This timeframe is often underrepresented in the literature, as most studies concentrate on long-term neurological recovery, fusion/stabilization rates, and late complications [33–35]. However, from a patient-centered perspective, persistent neurological symptoms in the immediate postoperative period may substantially affect quality of life, psychological well-being, and engagement in rehabilitation [36]. Early postoperative neurological status must therefore play a critical role in shaping the overall recovery trajectory.

Evidence from lumbar spine surgery supports this concept. Studies on lumbar microdiscectomy have demonstrated that early postoperative pain relief and neurological improvement strongly predict long-term surgical success, despite differences in anatomical region and pathology [37]. Similarly, longitudinal studies monitoring neurological recovery after spinal cord decompression have shown a significant correlation between the severity of residual postoperative symptoms and final functional outcomes [38,39]. These findings reinforce the clinical relevance of identifying factors that influence early neurological recovery after ACDF.

The age distribution of our cohort was heterogeneous, ranging from 23 to 79 years, with a mean age of 52.20 ± 11.84 years. This supports existing evidence that cervical disc disease predominantly affects older individuals. Progressive deterioration of intervertebral discs with aging is well documented and is largely attributed to chronic mechanical stress [40]. Such stress induces myxomatous degeneration of the annulus fibrosus, leading to collagen fiber disorganization and cyst formation, which weaken the posterior disc wall and predispose it to herniation into the spinal canal - particularly in the lordotic cervical spine [41]. The dynamic cervical spine model by Sadegh and Tchako demonstrated that maximal stress concentrations typically occur between the C4 and C6 vertebral levels, corresponding to the apex of the cervical lordosis (Cobb angle) [42]. In line with these observations, the C5–C6 level was the most frequently operated segment in our study.

In our cohort, isolated cervical radiculopathy and myelopathy were nearly equally represented. We did not observe a statistically significant difference in early postoperative neurological recovery between these two groups. This finding contrasts with some reports, such as that of Toci et al. [43], who described more pronounced early motor recovery in patients with myelopathy. However, those authors also noted that minimal overall clinical improvement was more common in patients with radiculopathy and that differences were not significant when stricter outcome criteria were applied. Given these inconsistencies, it appears likely that early and late neurological recovery are more strongly influenced by the degree and duration of neural compression, as well as preoperative symptom severity, rather than by the specific type of neurological deficit alone [44,45].

A high proportion of patients in our study (81.7%) demonstrated radiographically evident cervical spondylosis, with pronounced degenerative changes observed in 61.7%. Despite this, we found no significant association between the presence or severity of spondylosis and early postoperative neurological recovery. This finding is consistent with observations by Lehmann et al. [46], who reported that new or persistent neurological deficits after ACDF may occur at cervical levels other than the operated segment. Such deficits may be attributed to multilevel degenerative changes and dermatomal overlap caused by progressive spondylosis at adjacent or distant levels. Notably, the prevalence of spondylosis in their cohort was 2.5 times lower than in ours, yet similar conclusions were reached. Collectively, these findings suggest that the extent of spondylotic degeneration alone is not a reliable predictor of early or delayed neurological recovery.

In contrast, the type of disc lesion emerged as a significant determinant of early postoperative neurological outcome. Patients with disc protrusion demonstrated significantly better early neurological recovery compared to those with disc extrusion. This finding was clinically intuitive, as disc extrusion represents a more advanced pathological state associated with greater spinal canal compromise and more severe neural compression. Previous studies have consistently shown that the extent of compression is inversely related to the potential of neurological recovery, particularly in the early postoperative period [44,45].

Conclusion

This study demonstrated that disc protrusion is a statistically significant predictor of more favorable early postoperative neurological recovery following anterior cervical discectomy and fusion compared with disc extrusion. Additionally, the number of operated levels was significantly associated with early neurological improvement, as well as with the incidence of postoperative complications. In contrast, neither the type of neurological deficit nor the presence of cervical spondylosis showed a significant correlation with early postoperative neurological recovery.

Considering these findings, together with the inherent limitations of a retrospective study design, we emphasize the clinical importance of systematic assessment of early postoperative neurological status in patients undergoing Anterior Cervical Discectomy and Fusion. Early recovery may reflect the immediate effectiveness of neural decompression and may serve as important prognostic indicator for long-term functional outcomes. Identification of factors influencing this critical postoperative period may help optimize patient counseling, rehabilitation strategies, and overall surgical management.

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