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Original Article

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Clinical and Radiographic Outcomes of Cervical Disc Replacement Versus Posterior Endoscopic Cervical Decompression: A Matched-Pair Comparison Analysis

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Objective: To compare clinical and radiographic outcomes between 2 motion preservation surgeries, cervical disc replacement (CDR) and posterior endoscopic cervical decompression (PECD), for unilateral cervical radiculopathy.
Methods: Between February 2018 and December 2020, 60 patients with unilateral cervical radiculopathy who underwent either CDR or PECD were retrospectively recruited as matched pairs. Clinical outcomes included visual analogue scale (VAS) scores for neck and arm pain, Neck Disability Index (NDI), and satisfaction rates. The radiographic outcome was index level motion. Intraoperative data, complications, and hospital stay were collected. Preoperative and postoperative outcomes were compared.
Results: Patients undergoing CDR or PECD were included, with 30 cases in each group. Matched pairs were compared in terms of demographic data and preoperative measurements. CDR was associated with shorter operative times, whereas PECD resulted in less intraoperative blood loss. The total complication rate was 5%. NDI and VAS for neck and arm were significantly improved in both groups, with no significant differences between the 2 groups. Satisfaction rates of good and excellent exceeded 87% in both groups. CDR was superior to PECD in the restoration of disc height. Early postoperative follow-up showed no significant difference in terms of index level motion. PECD demonstrated significantly shorter hospital stays and quicker return-to-work times ($p < 0.05$).
Conclusion: PECD achieved equivalent clinical and radiologic outcomes compared with CDR when the certain criteria for surgery were met. Both techniques demonstrated the potential to maintain index level motion. Additionally, PECD resulted in less blood loss, shorter hospital stays, and faster return-to-work times. Conversely, CDR offered shorter operative times and better restoration of disc height.

Keywords: Unilateral cervical radiculopathy, Cervical disc replacement, Posterior full-endoscopic cervical decompression

INTRODUCTION

Cervical radiculopathy is a common neurological disorder characterized by nerve root disease, which is frequently caused by mechanical compression. Patients with cervical radiculopathy commonly present with pain or numbness localized to the neck and radiating into the arms.[1] This radicular pain is frequently accompanied by motor or sensory disorders. Radiculopathy has a variety of causes, including acute disk herniation, cervical spondylosis, and foraminal stenosis, but all result in compression and irritation of an exciting cervical nerve root.[2] According to an epidemiological study, the overall age-adjusted incidence of radiculopathy is 83 per 100,000 people.[3,4] The majority of cervical radiculopathy patients have a good prognosis. However, a major epidemiologic investigation found that 31.7% of patients with symptomatic cervical radiculopathy experienced symptom recurrence during a 5-year period following treatment, and 26% required surgical intervention for persistent pain, sensory disturbances, or physical weakness.[1,4]

During the last decade, cervical disc replacement (CDR), also known as cervical disc arthroplasty (Fig. 1), become a feasible alternative to anterior cervical discectomy and fusion (ACDF) for treating cervical radiculopathy and cervical myelopathy. Previous research has shown that CDR is as effective as ACDF based on the clinical benefits.[2] Another treatment is posterior percutaneous full-endoscopic cervical decompression (PECD), which may accomplish comprehensive nerve root decompression (Fig. 2). Therefore, PECD is a potential surgical option for patients suffering from unilateral cervical disc herniation or foraminal stenosis.[5] Both CDR and PECD are motion preservation surgeries for treating unilateral cervical radiculopathy caused by cervical disc herniation. However, there are no previous studies comparing the radiographic and clinical outcomes of CDR and PECD in treating unilateral cervical radiculopathy.

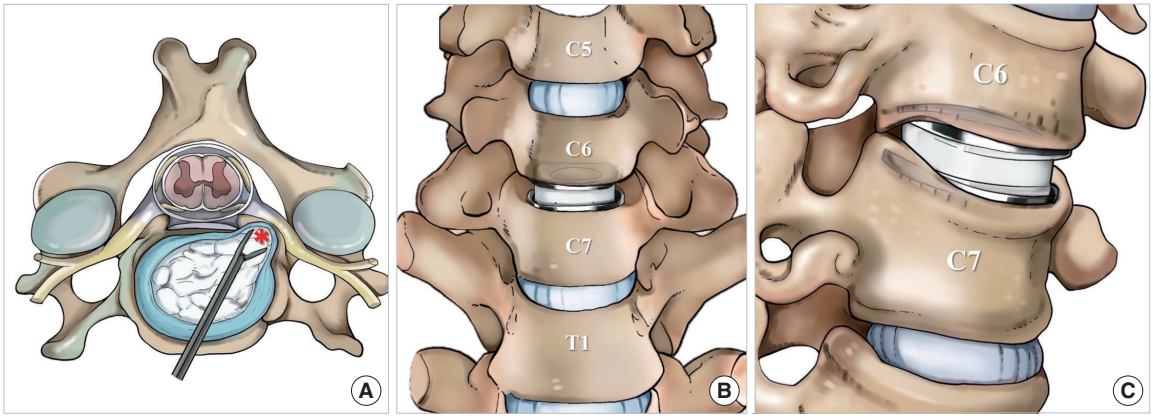

Fig. 1. Unilateral cervical disc herniation (red asterisk) with anterior cervical discectomy (A), cervical disc replacement in anterior view (B), and oblique view (C).

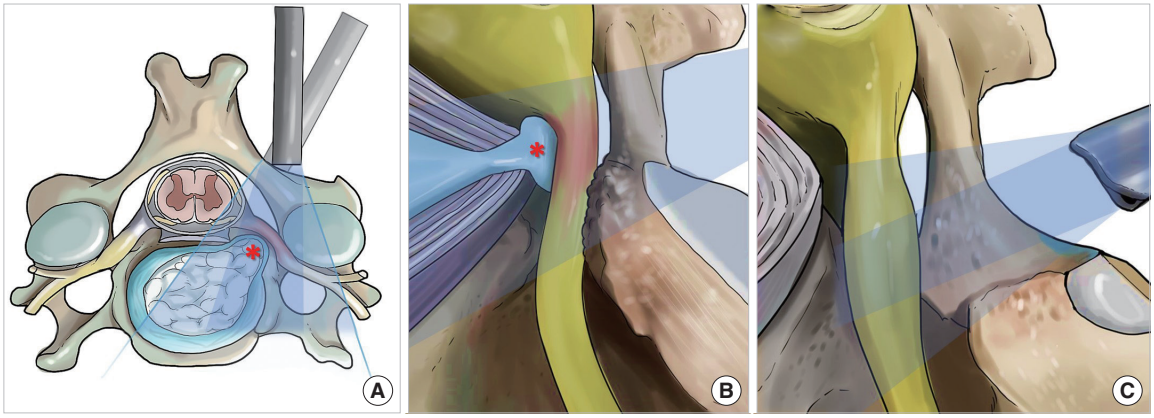

Fig. 2. Posterior percutaneous full-endoscopic cervical decompression (A), unilateral cervical disc herniation (red asterisk), posterior laminotomy and discectomy (B, C).

This study aims to report the first matched-pair analysis study to compare the clinical and radiographic outcomes between the 2 surgical techniques of CDR and PECD in treating unilateral cervical radiculopathy. We sought to determine the preoperative and postoperative patient satisfaction, as well as clinical and radiographic outcomes.

MATERIALS AND METHODS

1. Study Design

We retrospectively reviewed 60 patients with unilateral cervical radiculopathy caused by cervical disc herniation who underwent either CDR or PECD between February 2018 and December 2020. The Institutional Ethics Committee of the Queen Savang Vadhana Memorial Hospital approved the study protocol (IRB No. 028/2564). Informed consent of the patients was obtained for retrospective data collection. All patients' personal information remained confidential. There was no cost incurred, payment made, or harm done to the patients as a result of this study.

2. Study Population

The inclusion criteria included patients with unilateral cervical radiculopathy due to cervical disc herniation treated with CDR or PECD surgery during the study period. The study included patients aged 30 to 60 years. Clinical presentation and symptoms varied, including unilateral radicular pain, numbness, limited neck motion, motor weakness in the upper or lower extremities, and pain unresponsive to medication and rehabilitation. The shape of the disc herniation generally considered optimal for the procedure is sequestrated herniation, posterolateral herniation without calcified disc, and single-level unilateral cervical disc herniation. The exclusion criteria were patients with cervical instability or deformity due to severe spondylosis with disc height loss and movement of less than 2 degrees, tumor, infection, inflammatory disorders, congenital diseases, instability, congenital stenosis, ossification of the posterior longitudinal ligament (PLL), osteoporosis, history of recent cervical infection, and history of previous cervical surgery.

3. Materials and Surgical Techniques

In this matched-pairs analysis study, 60 patients with unilateral cervical radiculopathy caused by cervical disc herniation were divided into 2 groups. The first group (n = 30) was treated with CDR surgery using the Mobi-C cervical disc prosthesis

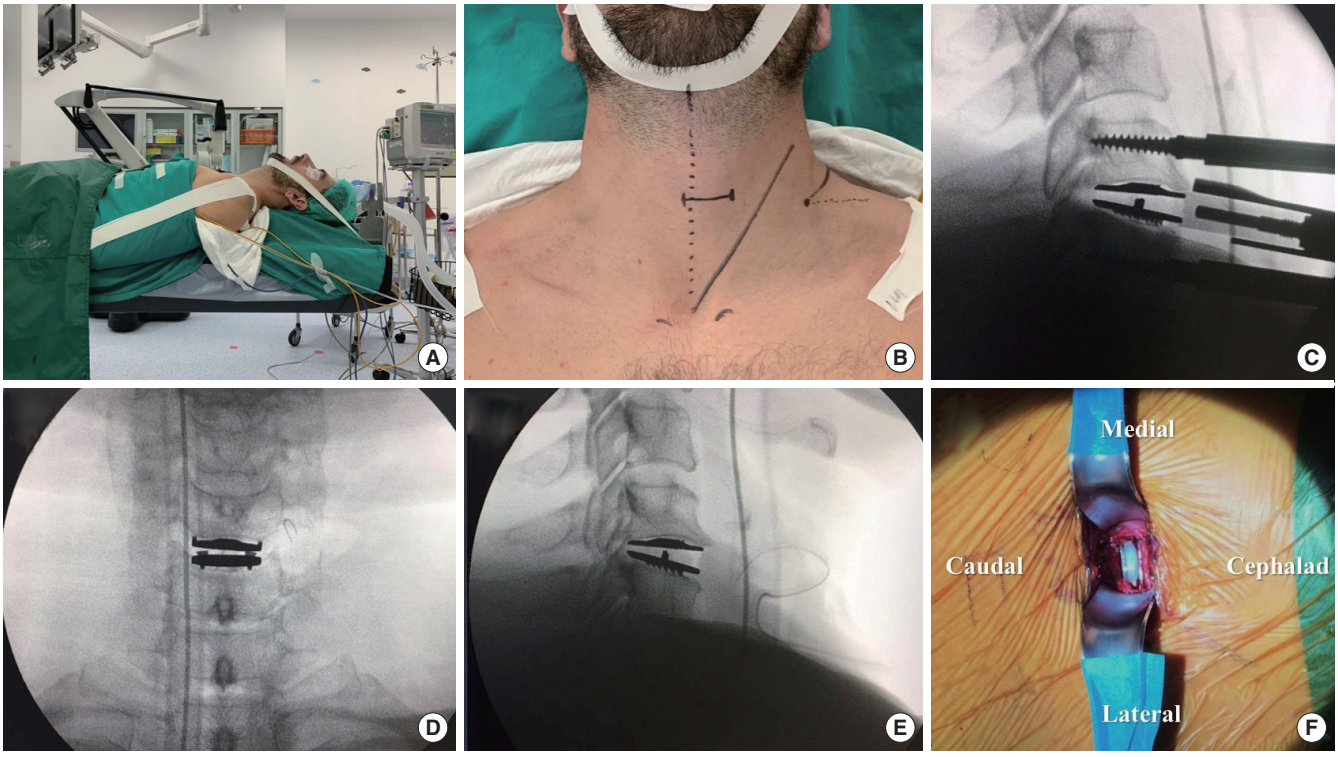

Fig. 3. (A) Patient in supine position with head stabilized by head strapping tape. (B) Surgical mark at index level. (C) Mobi-C cervical disc prosthesis placed with fluoroscopic assistance. Checking the position of the cervical prosthesis with fluoroscopic guidance in the anteroposterior view (D) and lateral view (E). (F) Active bleeding was checked and stopped.

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(LDR Spine USA, Inc., Austin, TX, USA), which is U.S. Food and Drug Administration (FDA)-approved for 1-level (8-7-2013, P110002). The Mobi-C cervical disc prosthesis, FDA-approved on August 7, 2013, is designed for 1-level CDR from C3 to C7. Constructed with cobalt-chrome alloy endplates and an ultra-high molecular weight polyethylene core, it features a mobile core for natural spinal motion, aiming to reduce adjacent segment disease. The device's titanium-coated endplates promote bone integration, and it is implanted via an anterior cervical approach. Clinical studies support its effectiveness in pain relief and functional improvement while preserving spinal motion.

4. Group 1: Cervical Disc Replacement

All patients in this group were operated under general anesthesia. Anterior approach to cervical spine (Smith-Robinson) was performed. The patient was placed in a supine position on a radiolucent table and the head was stabilized in extension by head strapping tape (Fig. 3A). The surgical incision landmark was checked and marked under fluoroscopic guidance. An incision was made to expose the anterior cervical spine at the pathology or index level (Fig. 3B). Microscope-assisted anterior cervical discectomy and resection of the PLL were performed. The balance gap and cervical disc prosthesis sizing measurements were completed, and the Mobi-C cervical disc prosthesis was then inserted under fluoroscopic guidance (Fig. 3C). The cervical alignment and proper position of the cervical disc prosthesis were confirmed (Fig. 3D, E). The bleeding was stopped (Fig. 3F), and the Radivac drain was placed. The incision was closed with absorbable suture.

5. Group 2: Posterior Endoscopic Cervical Decompression

In the PECD group, all patients were operated under general

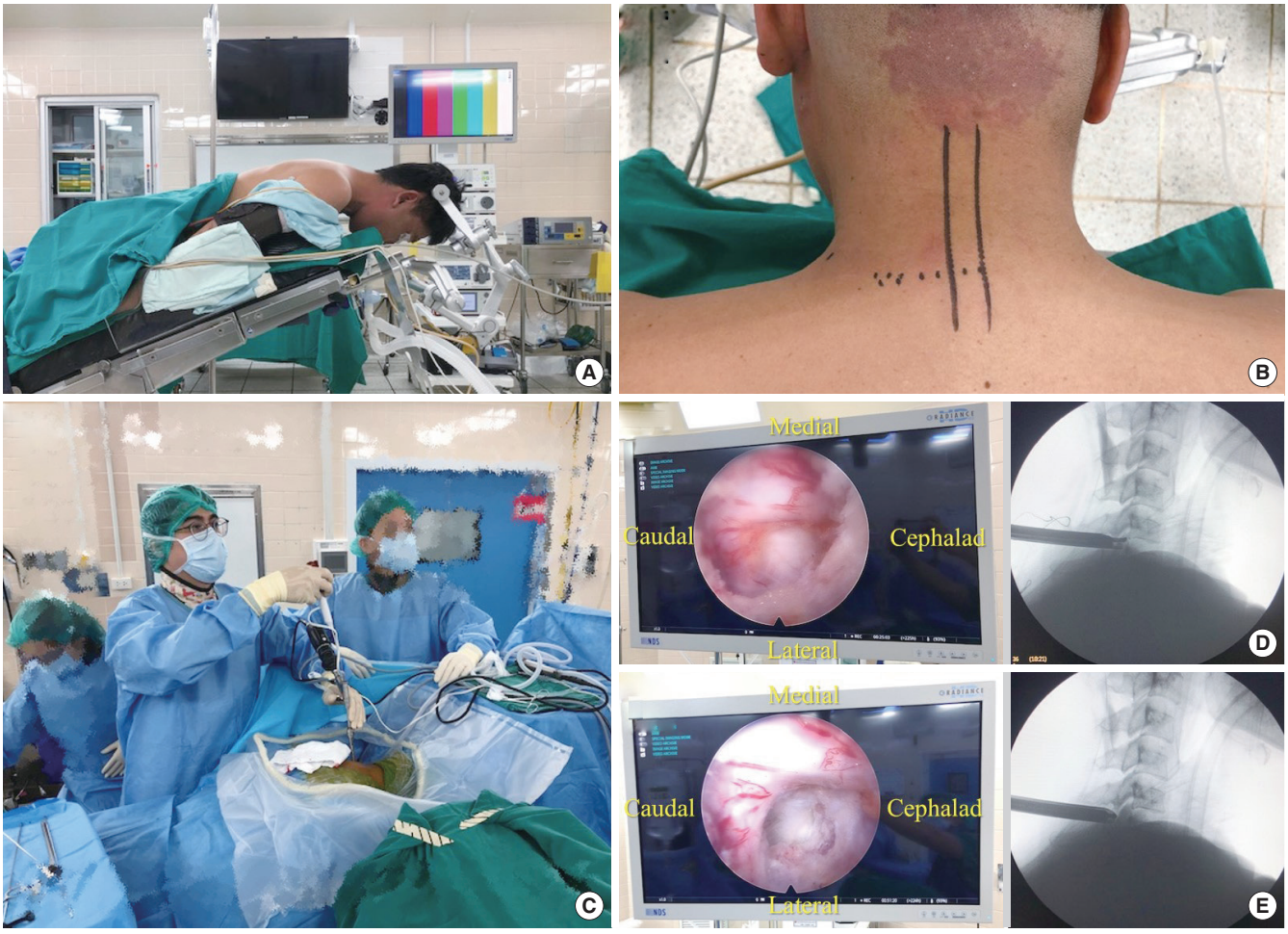

Fig. 4. (A) Patient in prone position with the head stabilized by a Mayfield holder. (B) The skin incision site was marked at 1 cm lateral to the midline at the index level. (C) The working sleeve and cervical endoscope application. (D) The interlaminar space after laminotomy. (E) The unilateral cervical disc herniation was removed under endoscopic monitor and fluoroscopic guidance.

anesthesia. The patient was placed in a prone position on a radiolucent table and with the head stabilized for cervical flexion using a Mayfield holder (Fig. 4A). The skin incision site was marked under fluoroscopic guidance (Fig. 4B), and surgical access was identified using anatomic landmarks. The skin entry point was determined at 1 cm lateral to the midline at the index level. The stab incision was made and the dilator was inserted, followed by the working sleeve and cervical endoscope (Fig. 4C). The interlaminar space (interlaminar V-point) was identified to perform laminotomy (Fig. 4D), and the unilateral cervical disc herniation was then removed (Fig. 4E) under endoscopic monitor and fluoroscopic guidance. Nerve root tension was evaluated for adequate decompression using a nerve hook. The bleeding was stopped and the incision was closed with absorbable suture.

The second group (n=30) was treated with PECD surgery using a cervical endoscope (Richard Wolf GmbH, Knittlingen, Germany). Data collected from both groups included sex, age, body mass index (BMI), smoking history, preoperative and postoperative clinical data (visual analogue scale [VAS] score for neck and arm pain, Neck Disability Index [NDI], and satisfaction rates), disc height and index level motion (Fig. 5), intraoperative data, complications, and duration of hospital stay. All preoperative and postoperative data for both groups were compared and analyzed.

6. Statistical Analysis

All statistical analyses were conducted using R ver. 3.1.0 (R

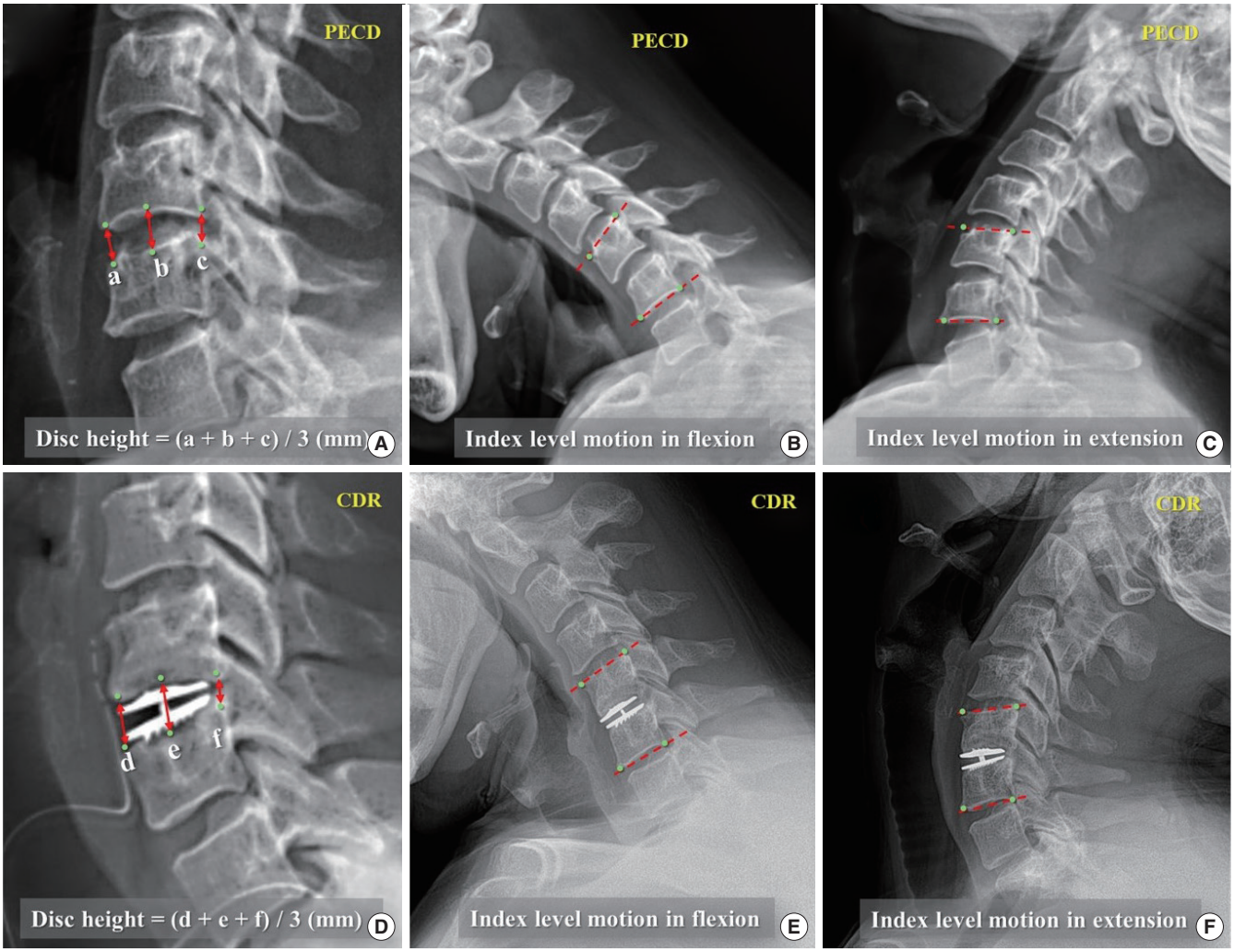

Fig. 5. Pre- (A) and postoperative (D) cervical disc height measurements from the lateral cervical radiograph: anterior disc height (a, d), middle disc height (b, e), and posterior disc height (c, f). A preoperative disc height = (a+b+c)/3 (mm) and a postoperative disc height = (d+e+f)/3 (mm). Index level motion = Cobb angles in flexion (B, E)+extension (C, F). PECD, posterior endoscopic cervical decompression; CDR, cervical disc replacement.

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Foundation for Statistical Computing, Vienna, Austria). Normally distributed data were analyzed with the Kolmogorov-Smirnov test. The data of both the CDR and the PECD groups were normally distributed. Comparisons of group means and variances were carried out using a Student paired t-test. Statistical significance was set at $p < 0.05$.

RESULTS

During the 2-year period of this study, 24 men and 36 women were included, with an average age of 38 years (range, 31–45 years). All baseline demographics and preoperative clinical evaluation data were shown in Table 1. The demographics of the CDR group (n = 30) were compared with those of the PECD group (n = 30). The mean age was 38 ± 6.43 years in the CDR group and 38 ± 3.23 years in the PECD group (p = 0.969). The male-to-female ratio was 6:14 and 8:12, respectively. The BMI was 23.21 ± 1.28 kg/m^2 in the CDR group and 24.75 ± 3.43 kg/m^2 in the PECD group (p = 0.083). The smoker-to-non-smoker ratio was 1:19 in both groups. Regarding preoperative radiographic measurements, the disc height was 4.75 ± 2.64 mm in the CDR group and 4.91 ± 3.21 mm in the PECD group (p = 0.871). The index level motion was 13.50° ± 3.18° in the CDR group and 12.20° ± 4.26° in the PECD group (p = 0.307). For preoperative pain and disability, the NDI was 45.35% ± 10.26% in the CDR group and 47.26% ± 9.84% in the PECD group (p = 0.572). The VAS score for neck pain was 3.56 ± 1.64 in the CDR group and 3.46 ± 1.23 in the PECD group (p = 0.837). The VAS score for arm pain was 7.41 ± 1.22 in the CDR group and 6.58 ± 2.52 in the PECD group (p = 0.217). None of the preoperative patient characteristics showed significant differences between the groups. However, there was a significant difference in the follow-up duration, with 18.6 ± 3.75 months in the CDR group and 12.20 ± 4.52 months in the PECD group ($p < 0.05$).

The results of the comparison of postoperative outcomes between the CDR and PECD were shown in Table 2. The radiographic measures included cervical disc height and index level motion. The cervical disc height in the CDR group was significantly higher than that in the PECD group at the 3-month, 6-month, and 1-year follow-ups ($p < 0.05$) (Fig. 6). The index

Table 1. Patient characteristics

Characteristic	Cervical disc replacement group (n = 30)		Posterior endoscopic cervical decompression group (n = 30)		p-value
	Value	95% CI	Value	95% CI	
General information					
Age (yr)	38.00 ± 6.43	35.70–40.30	38.00 ± 3.23	36.84–39.16	0.969
Sex					
Male	11 (37)		13 (43)	-	-
Female	19 (63)		17 (57)	-	-
BMI (kg/m^2)	23.21 ± 1.28	22.75–23.67	24.75 ± 3.43	23.52–25.98	0.0832
Patient history					
No underlying disease	30 (100)		30 (100)	-	-
Smoker	2 (7)		2 (7)	-	-
Nonsmoker	28 (93)		28 (93)	-	-
Radiographic measures					
Cervical disc height (mm)	4.75 ± 2.64	3.81–5.69	4.91 ± 3.21	3.76–6.06	0.8712
Index level motion (°)	13.50 ± 3.18	12.36–14.64	12.20 ± 4.26	10.68–13.72	0.3068
Clinical measures score					
NDI (%)	45.35 ± 10.26	41.68–49.02	47.26 ± 9.84	43.74–50.78	0.5724
VAS for neck (point)	3.56 ± 1.64	3.02–4.10	3.46 ± 1.23	2.97–3.95	0.8373
VAS for arm (point)	7.41 ± 1.22	6.95–7.87	6.58 ± 2.52	5.51–7.65	0.2171
Follow-up duration (mo)	18.60 ± 3.75	17.06–20.14	12.20 ± 4.52	10.71–13.69	0.0001*

Values are presented as mean ± standard deviation or number (%).
CI, confidence interval; BMI, body mass index; NDI, neck disability index; VAS, visual analogue scale.

Table 2. Postoperative outcome comparison between cervical disc replacement and posterior endoscopic cervical decompression

Characteristic	Preoperative measures at day 0					Postoperative measures (follow-up at 3 mo)					Postoperative measures (follow-up at 6 mo)					Postoperative measures (final follow-up at 1 yr)				
	CDR group	95% CI	PECD group	95% CI	p-value	CDR group	95% CI	PECD group	95% CI	p-value	CDR group	95% CI	PECD group	95% CI	p-value	CDR group	95% CI	PECD group	95% CI	p-value
Radiographic measures																				
Cervical disc height (mm)	4.75 ± 2.64	3.80–5.70	4.91 ± 3.21	3.76–6.06	0.871	7.57 ± 3.38	6.36–8.78	4.87 ± 4.25	3.35–6.39	0.042*	7.46 ± 4.26	5.94–8.98	4.76 ± 3.66	3.45–6.07	0.049*	7.38 ± 4.23	5.87–8.89	4.69 ± 3.64	3.39–5.99	0.049*
Index level motion (°)	13.5 ± 3.18	12.36–14.64	12.20 ± 4.26	10.68–13.73	0.307	12.30 ± 2.14	11.53–13.07	12.50 ± 3.22	11.35–13.65	0.828	12.0 ± 4.26	10.48–13.52	11.80 ± 2.45	10.92–12.68	0.864	11.80 ± 3.21	10.65–12.95	12.10 ± 4.32	10.56–13.64	0.815
Clinical measures score																				
NDI (%)	45.35 ± 10.26	41.68–49.02	47.26 ± 9.84	43.74–50.78	0.572	22.13 ± 11.42	18.05–26.21	23.17 ± 16.32	17.33–29.01	0.826	22.76 ± 14.36	17.63–27.89	25.74 ± 17.35	19.53–31.95	0.578	20.42 ± 8.46	17.39–23.45	22.14 ± 16.35	16.29–28.00	0.694
VAS for neck (point)	3.56 ± 1.64	2.97–4.15	3.46 ± 1.23	3.02–3.90	0.837	1.34 ± 1.66	0.75–1.93	2.43 ± 1.42	1.92–2.94	0.042*	1.75 ± 1.64	1.16–2.34	2.25 ± 1.85	1.59–2.91	0.397	1.54 ± 2.12	0.78–2.30	2.64 ± 1.24	2.19–3.09	0.017*
VAS for arm (point)	7.41 ± 1.22	6.97–7.85	6.58 ± 2.52	5.68–7.48	0.217	1.42 ± 2.21	0.63–2.21	1.79 ± 1.64	1.20–2.38	0.572	1.63 ± 1.53	1.08–2.18	2.21 ± 2.14	1.44–2.98	0.356	2.12 ± 2.17	1.34–2.90	1.94 ± 1.53	1.39–2.49	0.775

Values are presented as mean ± standard deviation unless otherwise indicated.
CDR, cervical disc replacement; CI, confidence interval; PECD, posterior endoscopic cervical decompression; NDI, neck disability index; VAS, visual analogue scale.
*$p < 0.05$, statistically significant differences.

Fig. 6. Histogram showing comparison of disc height between the cervical discreplacement (CDR) and posterior endoscopic cervical decompression (PECD) groups. Preop, preoperative; 3M, 3 months; 6M, 6 months; PO, postoperative; F/U, follow-up.

Fig. 7. Histogram showing comparison of index level motion between the cervical disc replacement (CDR) and posterior endoscopic cervical decompression (PECD) groups. Preop, preoperative; 3M, 3 months; 6M, 6 months; PO, postoperative; F/U, follow-up.

level motion in both the CDR and PECD groups decreased, with no significant difference between the 2 groups at the 3-month, 6-month, and 1-year follow-ups (Fig. 7). All clinical outcome measures, including the NDI (Fig. 8), VAS for the neck pain (Fig. 9), and VAS for the arm (Fig. 10), showed significant improvement in both groups at the 3-month, 6-month, and 1-year follow-ups. However, only the VAS score for the neck pain showed a significant difference between the 2 groups at the 1-year follow-up ($p < 0.05$). While the VAS scores for both the neck and arm pain, as well as the NDI, significantly improved compared to baseline in both groups, no significant differences were observed between the 2 groups.

The evaluation of patient satisfaction was shown in Table 3. The satisfaction rates of patients were evaluated using the modified MacNab criteria. The CDR group satisfaction results were

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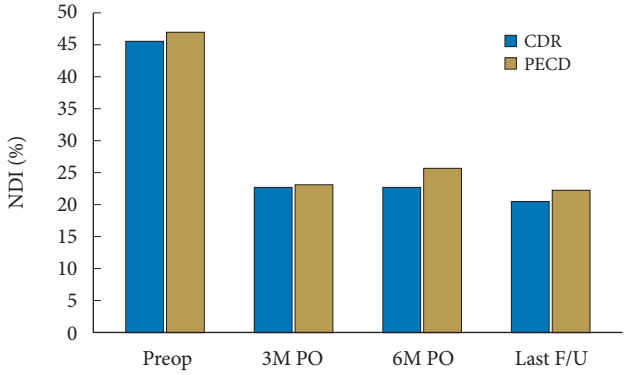

Fig. 8. Histogram showing comparison of neck disability index (NDI) between the cervical disc replacement (CDR) and posterior endoscopic cervical decompression (PECD) groups. Preop, preoperative; 3M, 3 months; 6M, 6 months; PO, postoperative; F/U, follow-up.

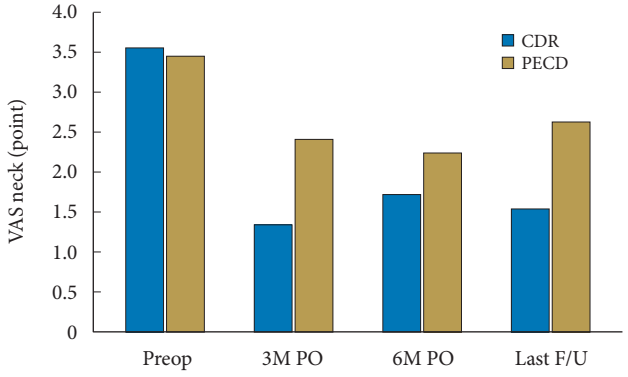

Fig. 9. Histogram showing comparison of visual analogue scale (VAS) for the neck between the cervical disc replacement (CDR) and posterior endoscopic cervical decompression (PECD) groups. Preop, preoperative; 3M, 3 months; 6M, 6 months; PO, postoperative; F/U, follow-up.

50% "excellent outcome," 35% "good outcome," and 15% "fair outcome." The PECD group satisfaction results were 40% "excellent outcome," 50% "good outcome," and 10% "fair outcome." No patients chose "poor outcome" in either group.

In terms of intraoperative and postoperative factors and complications, the PECD group had less estimated blood loss than the CDR group ($p < 0.05$). The total complication rate was 5% in both groups. The PECD group achieved significantly shorter hospital stays and return-to-work times ($p < 0.05$), without revision surgery or converting to open surgery. Two CDR cases had perioperative dysphagia, which had completely resolved at the 3-month follow-up. The intraoperative and postoperative factors and complications were shown in Table 4.

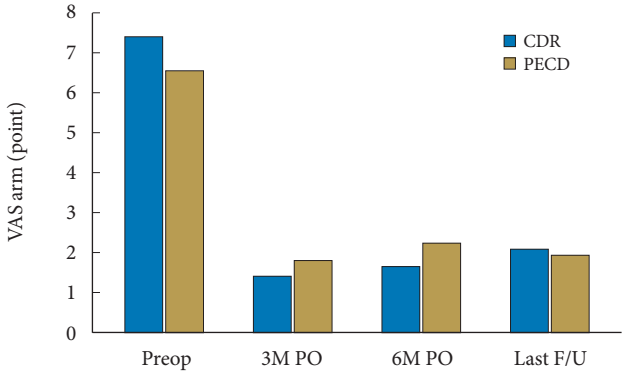

Fig. 10. Histogram showing comparison of visual analogue scale (VAS) for the arm between the cervical disc replacement (CDR) and posterior endoscopic cervical decompression (PECD) groups. Preop, preoperative; 3M, 3 months; 6M, 6 months; PO, postoperative; F/U, follow-up.

Table 3. Postoperative patient's satisfaction survey at 1-year follow-up

Characteristic	Cervical disc replacement group (n = 30)	Posterior endoscopic cervical decompression group (n = 30)	Total (N = 60)
Modified MacNab criteria			
Improved			
Excellent	15 (50)	12 (40)	27 (45)
Good	11 (37)	15 (50)	26 (43)
Not improved			
Fair	4 (13)	3 (10)	7 (12)
Poor	0 (0)	0 (0)	0 (0)

Values are presented as number (%).
Excellent: no pain, no restriction of mobility, return to normal work and level of activity; good: occasional no radicular pain, relief of presenting symptoms, able to return to modified work; fair: some improved functional capacity, still handicapped and/or unemployed; poor: continued objective symptoms of root involvement, additional operative intervention needed at index level irrespective of length of postoperative follow-up.

DISCUSSION

Unilateral cervical disc herniation is caused by the displacement of the nucleus pulposus of the intervertebral disc at the cervical level, causing direct compression of the spinal cord or nerve root impingement.[6,7] In general, herniation is thought to be caused by a combination of posterolateral annular stress and disc degeneration.[8] Disc bulging, protrusion, extrusion, and sequestration are the 4 kinds of herniated nucleus pulposus in the cervical spine.[6-8] Unilateral cervical radiculopathy caused by a herniated disc can be managed by nonoperative or operative

Table 4. Intraoperative and postoperative factors and complications

Characteristic	Cervical disc replacement group (n = 30)		Posterior endoscopic cervical decompression group (n = 30)		p-value
	Value	95% CI	Value	95% CI	
Intraoperative factors					
Estimated blood loss (mL)	20.1 ± 10.6	16.14–24.06	5.4 ± 15.2	-0.28 to 11.08	0.002*
Operation time (min)	42.3 ± 13.1	37.41–47.19	48.3 ± 20.1	40.79–55.81	0.296
Radiation time exposure (min)	3.2 ± 6.3	0.85–5.55	1.7 ± 4.8	-0.09 to 3.49	0.427
Perioperative complications					
No complications	27 (90)	-	30 (100)	-	-
Dysphagia	3 (10)	-	0 (0)	-	-
Postoperative clinical assessments					
Perioperative dysphagia completed resolved	3/3 (100)	-	0 (0)	-	-
Hospital stay (day)	3.2 ± 2.6	2.23–4.17	1.2 ± 1.5	0.64–1.76	0.008*
Return to work (day)	12.7 ± 10.4	8.82–16.58	5.2 ± 8.5	2.03–8.37	0.024*
Revision surgery or convert to open surgery	0 (0)	-	0 (0)	-	-

Values are presented as mean ± standard deviation or number (%).
CI, confidence interval.
*$p < 0.05$, statistically significant differences.

treatment.[9] Although operative treatment of a unilateral cervical herniated disc has been demonstrated to be beneficial, studies have shown that nonoperative treatment can provide similar results, and that conservative treatment is typically favored since it eliminates the risks and complication of conventional surgical treatment.[10,11] Surgery-related complications, implant-related complications, and alterations in the cervical spine's physiological biomechanics are all possible causes of complications after CDR. A previous meta-analysis[12] revealed that postoperative complications were uncommon, with the incidence of dysphagia as low as 4.7% and dural tear occurred in 1.3% of patients.[13] On the other hand, according to a previous systematic review and meta-analysis,[14] reports of complications associated with PECD for single-level disc herniation suggested that the dural tear rate was 1.5% and transient root palsy was 4.5%.[14] However, to date no study has compared the complications and outcomes of CDR with PECD.[15]

On initial presentation of a patient with acute radicular pain, nonoperative or conservative medication could be the first approach. However, patients who do not respond to nonoperative or conservative treatment are recommended for surgery. In the past decade, minimally invasive surgery has advanced and developed quickly. Previous systemic reviews[11] report that operative management is better than nonoperative treatment in terms of VAS and NDI scores, and that operative treatment is superior to conservative treatment, showing better progress within less than a year following treatment.[11] By following certain clinical standards, surgical operations can be conducted safely and effectively under microscopic or endoscopic guidance.[9,11]

This study is the first to compare the radiographic and clinical outcomes of CDR and PECD in unilateral cervical radiculopathy. The results demonstrated that both CDR and PECD are effective surgical techniques that optimize clinical and radiological outcomes. As motion-preserving surgeries, both techniques effectively treated unilateral cervical radiculopathy caused by cervical disc herniation. Clinical outcomes, including VAS and NDI scores, significantly improved in both groups compared to baseline, with no significant differences between the groups. Additionally, patients undergoing PECD experienced reduced blood loss, shorter hospital stays, and quicker returns to work compared to those undergoing CDR. Patient satisfaction, as measured by the modified MacNab criteria, was over 86% in both groups, with outcomes rated as "excellent" or "good." While CDR was superior to PECD in restoring disc height, there was no significant difference in index level motion between the groups during early postoperative follow-up periods. However, the high satisfaction rates reported using the modified MacNab criteria are significant but warrant careful consideration due to potential biases and methodological factors. These rates were likely influenced by the timing and mode of survey administration, with possible social desirability and recall biases affecting self-reported outcomes. Selection bias could also play a role if the

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survey response was not representative of the entire patient population. To improve the reliability of these findings, future studies should consider using anonymized and blinded assessments, longitudinal follow-ups, and combining subjective satisfaction measures with objective clinical outcomes to provide a more balanced and accurate understanding of patient satisfaction.

The follow-up duration between the CDR group (18.6 months) and the PECD group (12.2 months) is presented as demographic data in Table 1. However, in our study, we reported a matched-pair comparison analysis between CDR and PECD at day 0, follow-up at 3 months, follow-up at 6 months, and final follow-up at 1 year. All authors were unbiased in this comparison, as we compared the outcomes at the 1-year mark. Appropriate patient selection is crucial for achieving satisfactory outcomes following CDR and PECD. Both techniques are suitable for single-level cervical disc herniation without cervical instability. These results suggest that PECD is not inferior to CDR in clinical outcomes for at least 1 year postoperatively. Both CDR and PECD are effective treatment options when performed according to specific clinical standards. PECD is preferable when the herniated disc is confined to one side, resulting in unilateral radiculopathy without cervical myelopathy. Our results, however, revealed that CDR more effectively restores disc height, suggesting that CDR may be a better surgical option for patients with narrow disc spaces in terms of long-term outcomes. Nevertheless, long-term studies are required to provide further evidence for both techniques.

While the study reports statistically significant differences in factors such as disc height, blood loss, and hospital stay between CDR and posterior endoscopic cervical decompression, the clinical significance of these differences is not always clear. For instance, the difference in blood loss, though statistically significant, may have minimal impact on patient outcomes. Conversely, the shorter hospital stay and quicker return to work associated with posterior endoscopic decompression could have more meaningful clinical implications, reflecting faster recovery and reduced healthcare costs. Comparing these findings with existing literature highlights that while some statistical differences align with known benefits of minimally invasive techniques, their clinical relevance must be carefully evaluated in the context of patient care and overall recovery.[16]

Several factors must be considered regarding the cost-effectiveness of CDR, PECD, and open surgery for cervical spine disorders. CDR, while often more expensive due to the cost of advanced prosthetic devices and the specialized nature of the surgery, may offer long-term benefits such as reduced rates of adjacent segment degeneration and potentially faster recovery times, which could offset the initial higher costs. PECD, on the other hand, tends to be less invasive, resulting in lower immediate surgical costs and a shorter recovery period, but may have limitations in addressing more complex or severe disc pathologies.[17,18] Open surgery, while traditionally effective and providing direct access to the affected areas, generally incurs higher costs due to longer hospital stays and a more extended rehabilitation period. Ultimately, the choice between these approaches should be guided by a balance of clinical effectiveness, long-term outcomes, and the economic implications for the healthcare system and the patient.[17,18]

The study had several limitations. First, the data were retrospectively collected from the hospital database for each treatment group. Since this was a matched cohort study, there was a lack of randomization, which may introduce inherent selection bias. Second, the sample size was relatively small due to the specific indications for both CDR and PECD. Further research, such as a randomized controlled trial or a multicenter prospective observational study, comparing the effects of CDR and PECD in a larger cohort, would be beneficial.

CONCLUSION

The conclusion could be more effectively communicated by emphasizing key findings that support the noninferiority of PECD compared to CDR. PECD achieved equivalent clinical and radiologic outcomes compared with CDR for at least 1 year postoperatively when certain surgical criteria were met. Both techniques demonstrated the potential to maintain index level motion. However, PECD offered specific advantages, including less blood loss, shorter hospital stays, and faster return-to-work times. In contrast, CDR was associated with shorter operative times and better restoration of disc height. Further randomized controlled studies with long-term follow-up are required to validate these findings.

NOTES

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