MEDICAL RECORDS-International Medical Journal

Research Article

Comparison of Mid-Long Term Results of Cervical Cage and Cervical Disc Prosthesis in Patients with Single Level Cervical Disc Herniation

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Abstract

Aim: Continuous advancements in technology have facilitated the maintenance of spinal biomechanical properties, emphasizing the preservation of functional spinal segments. Therefore, this study focuses on comparing the mid- to long-term outcomes of cervical cage and cervical disc prosthesis (CDP) in patients with single-level cervical disc herniation.
Material and Method: This study included 51 patients diagnosed with cervical disc herniation. Among these, 25 underwent CDP, while 26 received a cervical cage. The mean follow-up period was 7.3 years. All surgeries were performed between 2021 and 2022 at a hospital in Türkiye. It was ensured that none of the patients had a prior history of spinal surgery. The demographics of the two groups were comparable. Radiographic evaluations and clinical outcomes were assessed, focusing on degenerative changes, cervical spine motion, and radicular pain in both groups.
Results: The mean age in the CDP group was 46 years, compared to 43 years in the cervical cage group. Recurrent cervical pain was observed in only one patient in the CDP group, whereas it was reported in eight patients in the cervical cage group over the 7.3-year follow-up period.
Conclusion: In conclusion, CDP was found to be a more effective treatment compared to cervical cage in patients with cervical disc herniation.

Keywords: Cervical cage, cervical disc prosthesis, cervical disc herniation, cervical pain

INTRODUCTION

Cervical disc herniation (CDH) is a common condition which is caused due to the rupture of a disc in a weak spinal area that results in pain and impacts the quality of life due to neurological defect (1). This can be caused due to age, continuous movements or sudden injury (2). The symptoms linked to this disease are neck pain, muscle weakness, numbness (3).

Treatment of CDH depends upon the severity of the disease. The treatment leads to surgery or else there are two other options; cervical disc prostheses (CDP) or cervical cage implants (4). It is highly prevalent in Eurasian Region (Europe and Asia) where doctors are struggling to rule out surgical options (5). The choice in choosing either cervical cage implant or CDP depends upon the age of the patient, degree of injury, and surgical goals.

Comparing the mid-long term results of surgical treatments of CDH patients is essential in addressing the pain relief and improvement seen in patients post-surgery along with that segment alignment is also monitored (6). Comparison of cost effectiveness helps analyze the procedure's cost and identify ways to perform these procedures more cost-effectively (7).

Cervical cage implants and CDH both procedures offer benefits to patients including improved movement and pain relief but at the same time these procedures have their own challenges for which understanding of regional disparities, patients preference and social and economic

CITATION
Kina H, Bozyigit B. Comparison of Mid-Long Term Results of Cervical Cage and Cervical Disc Prosthesis in Patients with Single Level Cervical Disc Herniation. Med Records. 2025;7(1):38-42. DOI:1037990/medr.1545650

Received: 09.09.2024 **Accepted:** 04.10.2024 **Published:** 25.12.2024
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factors is essential to provide effective care. Ongoing medical research opens the way to advancements in technology all the stakeholders should collectively design strategies in order to face these challenges and provide care to patients with CDH across the region. Proper monitoring and comparison of the two procedures helps clinicians in drawing a review that which procedure works best under which circumstance ultimately providing quality life to patients. The current study will undergo a review which can help doctors in taking decisions regarding surgery for patients with this condition.

MATERIAL AND METHOD

The study was planned as a retrospective comparative study. Ethics committee approval for the study was received from Istinye University human research ethics committee with the date and issue number 24-157. The 8-year postoperative follow-up data of 51 patients who underwent surgery for CDH, including 25 cases of CDP and 26 cases of anterior cervical discectomy and fusion, were retrospectively analyzed. In these file scans, the patients' ages, genders, levels of CDH, and neurological examinations at 8-year postoperative follow-up are included.

Inclusion criteria

- Individuals diagnosed with cervical disc degenerative disease.
- There were no signs of myelopathy in the participants who had radiating pain.
- Patients who had not undergone cervical surgery in the past.
- Patients who are experiencing symptoms of individual or multiple-level diseases.
- Considering the similar demographics observed between the groups, it is probable that gender and age were taken into account.
- Patient candidates who may undergo anterior cervical discectomy with cage implantation or artificial CDP insertion (Prestige II).

Exclusion criteria

- Myelopathy symptoms present.
- Past surgical procedures involving the cervical region.
- Cervical disc replacement and cage implantation are not appropriate procedures for certain individuals.
- Surgical procedures or research results might be compromised in patients with co-morbidities or other serious health issues.
- Lack of competency to offer informed permission.
- Patients whose structural or anatomical anomalies might affect the success or failure of the surgical operations.

During each operation, the single surgeon carried out the procedures in the identical manner. Patients who had not undergone cervical surgery in the past and who were suffering from symptomatic single or multiple level illnesses were eligible to participate in the trial. A total of twenty-five patients were assigned to the Prestige II group, whereas twenty-six patients were assigned to the arthrodesis (control) group. Comparable demographics were found among the cohorts. In each and every one of the patients, the standard right anterior cervical approach was utilized (8,9). In three patients, two-level procedures were conducted, and the disc was removed. This was followed by the placement of a prosthesis of the same size. A similar method was utilized in six patients who were part of the cage group. In order to make a comparison between the therapy groups, standardized clinical outcome measures and radiographic tests were utilized at the required post-operative intervals. The evaluation of each patient included the utilization of static and dynamic cervical spine radiographs, in addition to magnetic resonance imaging (MRI) where it was deemed required. The visual analogue scale for neck and arm discomfort, the neck disability index, and the 36-Item Short Form Health Survey (SF-36) were all components of the clinical examination carried out. The specifics of any difficulties and subsequent surgeries were also taken into consideration.

Statistical Analysis

Power analysis of the study: In our power analysis, it was calculated that the required number of patients should be 52 for the effect size to be 0.70, alpha 0.05, and the power to be 80%. (G*Power 3.1.9.7). Statistical method used in the study: Statistical analysis was carried out using IBM SPSS 19 package program (IBM Software, New York, USA), and the results were expressed as mean±standard deviation for continuous variables, after the normal distribution of continuous variables was confirmed with the Kolmogorov Smirnov test, and Wilcoxon signed rank test was used for dependent continuous variables. The statistical significance level was accepted as 0.05 for all tests.

RESULTS

For this study, the mid-long term results are compared within the context of cervical cage and CDP in patients with single level CDH. For this purpose, two groups of patients, with single level CDH, were taken into account for this purpose. Group 1 included the patients (25 individuals), treated with CDP, while group 2 (26 individuals) included the patients with cervical cage. The mean age of the patients within the CDP group was found to be 46 years, ranging from 30 to 62 years, while the mean age within the cage group was found to be 43 years, ranging from 31 to 61 years.

Distribution of Sex

Table 1 shows the distribution of sex among the included patients for both CDP and cervical cage. For this study, a total of 51 patients with single level CDH were taken into account. 25 of these patients were included in CDP,

incorporating 8 male individuals and 17 female individuals, while cervical cage group included a total of 26 patients, integrating 10 male individuals and 16 female individuals.

Table 1. Distribution of sex

Sex	CDP (n=25)	Cervical cage (n=26)
M	8	10
F	17	16

Patient Distribution in CDP Group

Within the context of CDP, 20 patients were presented with paresthesia as well as "unilateral radicular pain (URP)." However, three patients were presented with "bilateral radicular pain" and 9 were presented with deficits of "pre-operative focal motor." Table 2 shows that 19 of the cases within the context of CDP group had "single level disc herniation" as shown by MRI, while three of the patients had "two level disc herniation," incorporating 2 consecutive levels. However, three of the patients were also investigated before the operation with discography to ensure the disc as pain pathology.

Table 2. Patient no. and distribution in CDP and cervical cage group

Level	CDP	Cervical cage
C4-C5	1	
C5-C6	8	10
C6-C7	10	10
C4-C5 & C5-C6	3	2
C5-C6 & C6-C7	3	4

Patient Distribution in Cervical Cage Group

For cervical cage group, all incorporated patients were presented with paresthesia and radicular pain, without any motor neurological deficiencies. In this regard, "single level disc herniation," was observed in 20 cases via MRI, while "two level disc herniation," was observed in 6 cases as shown in Table 2.

Mean hospital stay of the patients was found to be 2.6 days within both groups. However, one of the patients in CDP group had "transient recurrent nerve paralysis," which was recovered in a 3-week period.

Follow-Up Results

Figures 1 and 2 show cage placement and disc space within the context of the patient from the associated CDP and cervical cage groups. In 18 cases, restoration was observed in cervical movements within the CDP group within four weeks as shown in Figures 3 and 4. After three months of surgery within 21 patients, the movements range was found to be similar as that of the pre-operative period. However, only 18 cases were capable to engage in their duties at a follow-up of two months. Two of the cases within the CDP group, lost mobility as observed in their follow-up period. One of this case experienced anterior osteophytes after eight months of the surgery while the other case lost mobility at seven months of operation. Contrarily, the patients of this group had effective neck movement (Figure 5). During the second year of follow-up, degeneration was observed in radiological findings of one case at upper disc level, incorporating refractory pain to the traditional treatment. This case also went through prosthesis removal, following the fixation of C4-C6 and bone graft fusion, whereas, no difference was observed between cases with one or two levels within the CDP group.

Figure 1. Intraoperative cage placement

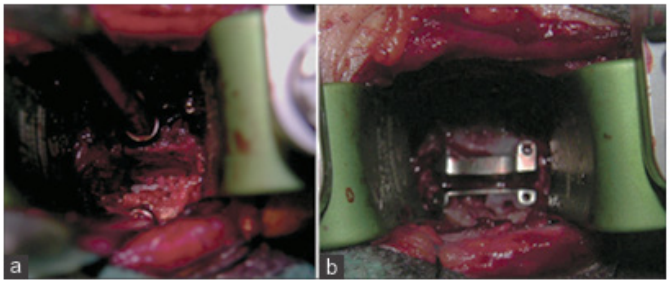

Figure 2. a. Intra-operative disc space after removal of disc, **b.** artificial disc within place

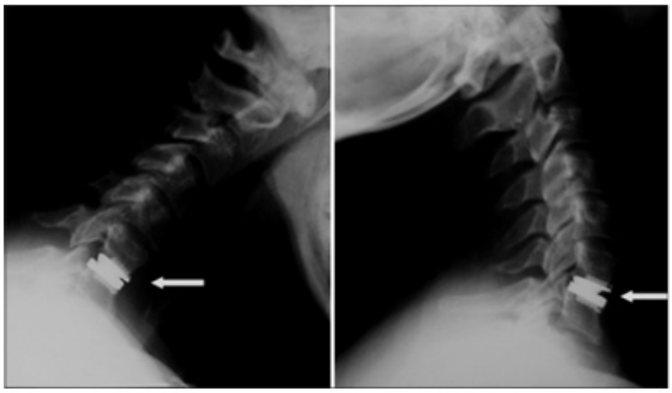

Figure 3. X-ray of cervical presenting "artificial cervical disc" movements

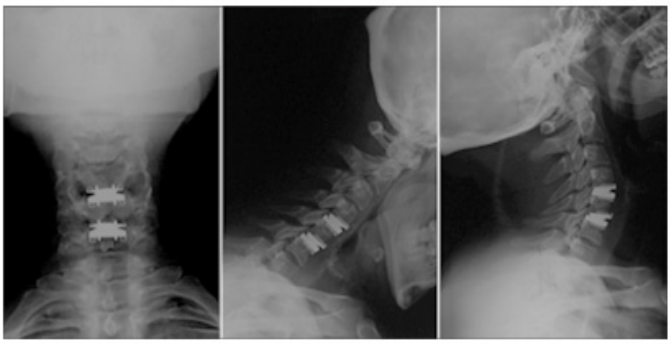

Figure 4. X-ray of cervical, presenting "artificial cervical disc" movements within the patient, incorporating disease at two level

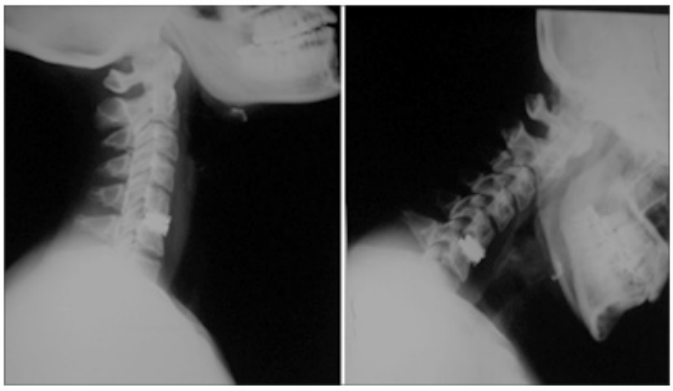

Figure 5. Follow-up shows that patients in cervical cage group, experienced seven time more recurrent pain as compared to CDP group

However, three of the patients who had CDP at multiple levels, had a follow-up of more than eighty months and they were found to have good mobility, as same as that of single-level CDP. However, in cervical cage group, one of the patients established arm pain which worsened over time. Within this context, neurological deficit was also observed because of the lesion of root nerve which took place during the surgery. For this purpose, analgesics were used for treating the pain. One of the patients from this group experienced nerve paralysis which was observed during the 4-week period after the surgery.

One of the patients with discectomy at double level, experienced wound hematoma which was needed to be evacuated urgently. Three of the patients had recurrent cervical pain, requiring local infiltration within a period of 3 to 6 months. Moreover, at 9 months, one of the patients went through rhizotomy in order to deal with consistent cervical pain. After cage removal is one of the patients, he was again operated after one year of surgery, leading to the application of circumferential arthrodesis at the center during the follow-up. In addition, during the follow-up, four patients for the cage group showed cervical degeneration, which later changed over a period of four years. In a follow-up period of 7.3 years, degenerative changes were observed at other cervical spine level in one of the patients from CDP group, while such changes were observed in seven patients from the cervical cage group (Figure 5).

DISCUSSION

Discussion revealed that individuals with single level CDH have their mid-long term results examined in relation to the cervical cage and CDP. A total of two patient groups with single-level CDH were considered for this purpose. Patients receiving CDP treatment and that receiving cervical cage treatment were categorized into two groups, with patients with paresthesia and URP seen in CDP settings. Some patients had pre-operative focal motor deficits and some patients had bilateral radicular pain. It demonstrates that, different cases in the CDP group had single level disc herniation, whereas some of the patients had two level disc herniation.

To confirm that the disc was the source of the discomfort, discography was used to examine the patients before the procedure. The cervical cage group patients experienced paresthesia and radicular discomfort without any motor or neurological system impairments (10). Cage location and disc space was evaluated in patients from both the CDP and cervical cage groups. Recovery of cervical motion was noted in the CDP group within four weeks. Three months after surgery, the range of motion for patients was determined to be comparable to the pre-operative period. The patients, however, remained able to perform their tasks after a two-month follow-up. Some patients in the CDP group experienced loss of mobility due to complications such as osteophyte formation. After eight months of surgery, one patient developed anterior osteophytes, and seven months after the procedure, the other patient lost movement (11). In contrast, the patients in this group were able to move their necks well. Degeneration was noted in one case's radiological results at the upper disc level during the second year of follow-up, adding refractory pain to the conventional therapy. After fixation and bone graft fusion, this patient also underwent prosthesis removal; nevertheless, within the CDP group, there was no distinction between cases with one or two levels (12). Nevertheless, after a follow-up of more than eighty months, the patients with multiple levels of CDP were found to have good mobility, comparable to that of single-level CDP. Patient in the cervical cage group, however, started experiencing arm discomfort that got worse with time. In this setting, a neurological impairment was also noted as a result of the root nerve damage that occurred during the surgical procedure (13). Analgesics were utilised to relieve the pain for this reason. During the four weeks following surgery, one of the patients in this group had nerve paralysis. One of the patients undergoing a double-level discectomy developed a wound hematoma that required immediate evacuation. Within three to six months, patients required local anesthetic injections due to persistent cervical discomfort. Patients underwent another operation a year after removing their cage, resulting in circumferential arthrodesis. Cage group patients experienced cervical deterioration, while CDP group patients experienced degenerative changes. Seven patients from cage group also experienced these changes.

Implications

Within the context of the Turkish healthcare system, the exploration regarding mid-long term results in patients with single-level CDH undergoing either CDP or cervical cage interventions has important implications. With regard to clinical practitioners, it provides valuable insights in order to guide them to enhance the quality of patient care need to follow the most effective and patient friendly intervention. Following the economic constraints, the study's findings have the potential influence regarding the decisions of resource allocations which postulates that which one is more cost-effective and yields superior outcomes so that resource distribution can optimize patient care and allocate resources efficiently. Furthermore, implications

intricate with surgical intervention trends in Türkiye. Based on the relative effectiveness of these treatments, surgeons may change their preferences which might have an effect on national training in specialization. The findings of the study may have a wider use in the development of health protocols and policies pertaining to the treatment of CDH in Türkiye. Based on these findings, national healthcare guidelines may be modified by incorporating comparisons of mid- to long-term outcomes of cervical cages and CDP that surpass prompt clinical decision making in Türkiye's healthcare system.

Limitations

A retrospective, single-center, cross-sectional study comparing the mid-term and long-term outcomes of cervical cage and CDP in patients with single-level CDH has valuable findings, but its authenticity and reliability are limited due to the fact that the primary data collection was from specific groups of people. Therefore, it was quite difficult to obtain the necessary data. In addition, since the current study focused on data from Türkiye, its results may not be representative of cervical cage and CDP in other world economies. The retrospective and observational design of the study precludes us from drawing any conclusions about causality. Future studies should consider other sources to compare with major world economies. In addition, the current study focused on two groups of patients with single-level CDH. There are also various other factors that may have a major impact on these groups and may affect the sample by understanding it. However, it is not possible to evaluate the impact of all important factors in a single study.

CONCLUSION

A total of 51 cases were included in this study. 26 had cervical cage surgery and 25 had CDP. For this investigation, a mean follow-up time of 7.3 years was taken into consideration. None of the participants in this study had a history of prior surgery. Clinical results and radiographic evaluations in both groups examined degenerative changes, cervical spine mobility, and radicular discomfort. Only one patient in the CDP group experienced recurrent cervical discomfort, whereas eight people in the cage group did so over a mean of 7.3 years which suggest that for patients with CDH, CDP was a more successful therapy than cervical cage.

Financial disclosures: *The authors declared that this study has received no financial support.*

Conflict of interest: *The authors have no conflicts of interest to declare.*

Ethical approval: *Ethics committee approval for the study was received from İstinye University Human Research Ethics Committee with the date and issue number 24-157.*

REFERENCES

1. Mazas S, Benzakour A, Castelain JE, et al. Cervical disc herniation: which surgery?. Int Orthop. 2019;43:761-6.
2. Guan Q, Xing F, Long Y, Xiang Z. Cervical intradural disc herniation: A systematic review. J Clin Neurosci. 2018;48:1-6.
3. Apaydın AS, Güneş M, Yana M. Investigation of functional disability, pain, and quality of life in patients with cervical radiculopathy by gender. Med Records. 2024;6:14-9.
4. Gunasekaran A, de Los Reyes NKM, Walters J, Kazemi N. Clinical presentation, diagnosis, and surgical treatment of spontaneous cervical intradural disc herniations: a review of the literature. World Neurosurg. 2018;109:275-84.
5. Kose SG, Kose HC, Celikel F, et al. Chronic pain: an update of clinical practices and advances in chronic pain management. Eurasian J Med. 2022;54:57-61.
6. Peng Z, Hong Y, Meng Y, Liu H. A meta-analysis comparing the short-and mid-to long-term outcomes of artificial cervical disc replacement (ACDR) with anterior cervical discectomy and fusion (ACDF) for the treatment of cervical degenerative disc disease. Int Orthop. 2022;46:1609-25.
7. Emami A, Coban D, Changoor S, et al. Comparing mid-term outcomes between ACDF and minimally invasive posterior cervical foraminotomy in the treatment of cervical radiculopathy. Spine (Phila Pa 1976). 2022;47:324-30.
8. Health Quality Ontario. Cervical artificial disc replacement versus fusion for cervical degenerative disc disease: a health technology assessment. Ont Health Technol Assess Ser. 2019;19:1-223.
9. He A, Xie D, Qu B, et al. Comparison between cervical disc arthroplasty and conservative treatment for patients with single level cervical radiculopathy at C5/6. Int J Surg. 2018;54:124-8.
10. Irmak A, Söylemez B. One-year outcome comparison of polyetheretherketone cage and disc prosthesis in cervical disc replacement surgery. Erciyes Med J. 2022;44:44-50.
11. Cui Y, Liu B, Zhou J, et al. Quantitative analysis of balance function characteristics in older patients with mild to moderate cognitive impairment. Exp Gerontol. 2023;182:112302.
12. Mu G, Chen H, Fu H, et al. Anterior cervical discectomy and fusion with zero-profile versus stand-alone cages for two-level cervical spondylosis: a retrospective cohort study. Front Surg. 2022;9:1002744.
13. Yilmaz M, Yucesoy K, Erbayraktar RS, Altinag RS. Anterior hybrid construction of multilevel cervical disc disease and spondylotic spinal stenosis: surgical results and factors affecting adjacent segment problems. J Orthop Surg Res. 2021;16:298.