

ORIGINAL
ARTICLE

Factors Affecting the Risk of Developing Cervical Cage Malposition in Patients with Cervical Discectomy

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ÖZET

Amaç: Dejeneratif servikal omurga hastalıklarının tedavisinde servikal diskektomi ve bir kafes yerleştirilerek füzyon sağlanması günümüzde en sık uygulanan yöntemlerden biridir. Bu cerrahi sonrası takiplerde görülebilen komplikasyonlardan biri servikal kafes çökmesidir. Bu çalışmada cerrahi sonrası erken dönemde çekilmiş olan servikal grafide görülebilecek olan son plak parlaklık kaybının, takiplerde servikal kafes çökmesi gelişmesi ile ilişkisi araştırılmıştır. **Yöntem:** 2013-2023 yılları arasında tek seviye servikal disk hernisi cerrahisi uygulanmış olan 100 hasta çalışmaya dahil edilmiştir. Hastalar cerrahi sonrası 60. gün kontrolünde çekilmiş olan servikal grafisinde kafes çökmesi olanlar ve olmayanlar olarak 2 gruba ayrılmıştır. Çalışmada yer alan tüm hastaların ameliyattan sonra ilk 24 saat içerisinde çekilmiş olan servikal grafi görüntülerinde kafese komşu omurlarda son plak parlaklık kaybı olup olmadığı incelenmiş ve elde edilen sonuçlar bu gruplar arasında kıyaslanmıştır. **Bulgular:** 89 hastada (%89) servikal kafes çökmesi saptanmazken, 11 hastada (%11) servikal kafes çökmesi geliştiği saptanmıştır. Kafes çökmesi gelişen 11 hastanın 8'inde (%72,7), kafes çökmesi meydana gelmeyen 89 hastanın ise 10'unda (%11,2) son plak parlaklık kaybı tespit edilmiştir. Bu sonuçlar göstermektedir ki erken dönem grafide saptanan son plak parlaklık kaybı ile ileri takiplerde gelişen servikal kafes çökmesi arasında anlamlı bir ilişki vardır ve son plak parlaklık kaybı tespit edilenlerde servikal kafes çökmesi görülme oranı daha fazladır ($p<0,001$). **Sonuç:** Cerrahiden hemen sonrası çekilmiş erken dönem servikal grafide son plak kortikal parlaklık kaybı saptanması, takiplerde kafes çökmesi ile karşılaşılma sıklığını arttırmaktadır. Bu nedenle bu hastaların daha kısa takip aralığı ile dikkatle takip edilmesi düşünülebilir.

Anahtar kelimeler: Servikal disk hernisi, Servikal diskektomi, Servikal kafes çökmesi

ABSTRACT

Aim: Cervical discectomy followed by cage placement for fusion is nowadays a commonly used method for the treatment of degenerative cervical spine diseases. One of the complications that can be observed during postoperative follow-up is cervical cage subsidence. At this point, it is investigated in this study the relationship between the loss of endplate brightness observed on early postoperative cervical radiographs and the development of cervical cage subsidence during follow-up. **Methods:** 100 patients who underwent single-level cervical disc herniation surgery between 2013 and 2023 were selected. The patients were divided into two groups based on the presence or absence of cage subsidence in cervical radiographs taken at the 60-day postoperative follow-up. In all patients included in the study, the presence of endplate brightness loss in the cervical radiographs taken within the day 1 of post-surgery period in the vertebrae adjacent to the cage was evaluated and compared between groups. **Results:** Cage subsidence was detected in 11 patients (11%), while it was not observed in 89 patients (89%). Among the 11 patients with cage subsidence, endplate brightness loss was identified in 8 patients (72.7%), whereas it was found in 10 patients (11.2%) among the 89 patients without cage subsidence. These results indicate a significant relationship between the loss of endplate brightness observed on early radiographs and the occurrence of cervical cage subsidence during later follow-up ($p<0.001$). **Conclusion:** The identification of endplate cortical brightness loss on early postoperative cervical radiographs increases the likelihood of encountering cage subsidence during follow-up. Therefore, these patients may require shorter follow-up intervals.

Keywords: Cervical disc herniation, Cervical discectomy, Cervical cage subsidence

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INTRODUCTION

Fusion by using a cage following cervical discectomy is a surgical method that is frequently performed in individuals with degenerative cervical spine disease (1). Titanium cages filled with autograft, polyetheretherketone (PEEK) cages or carbon cages are most commonly used in the fusion step following adequate decompression (2,3). Especially since the 1990s, the frequency of use of PEEK cages has increased due to its elasticity close to cortical bone, reducing stress on adjacent bone structures, radiolucent properties and high capacity to allow the development of bone fusion (3, 4). However, following the use of these implants, it may be encountered that a cage placed between two bones may be embedded in the adjacent bone over time in the postoperative period (5). Cervical cage collapse is defined as the embedment of the cage placed following cervical discectomy more than 2 millimeters (>2mm) into the adjacent cervical vertebra (6). As a result of this complication, instability in the cervical spine, recurrence of neurologic symptoms and loss of reconstruction may occur (7).

Many factors associated with the risk of cervical cage embedment have been discussed in the literature (7). Some of these

risk factors include advanced age, female gender, presence of osteoporosis or low bone mineral densitometry values, too large a cage and excessive curettage of vertebral endplates (7-9). In this study, we studied the relation between the loss of brightness of the endplate, which can be seen on cervical radiographs taken in the early postoperative period, and the development of cervical cage collapse during follow-up.

MATERIAL AND METHODS

Between 2013 and 2023, 100 patients who underwent single level cervical discectomy followed by fusion surgery with PEEK cage by a single center and the same surgeon were included in the study. Demographics, symptoms and neurologic examination signs on admission, early postoperative cervical radiographs taken within the first 24 hours postoperatively, and control cervical radiographs taken on the 60th postoperative day were retrospectively reviewed.

On the cervical radiograph taken at the 60th postoperative day follow-up, cervical cage collapse was considered to occur when the cage was embedded more than 2 mm into the bone (Figure 1).

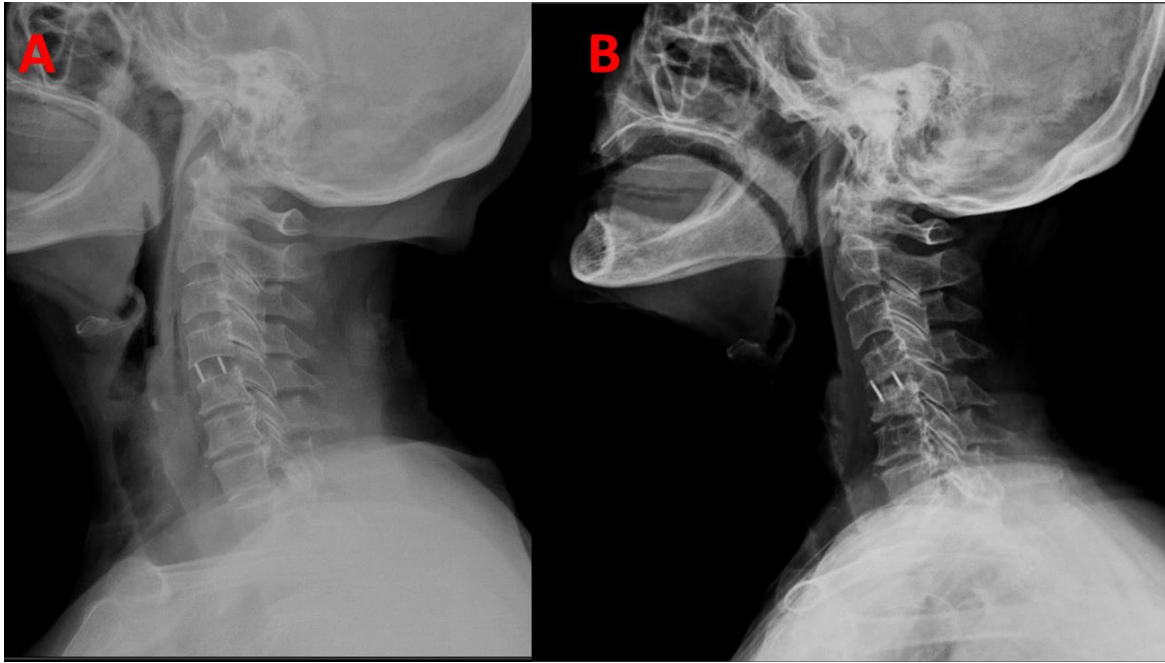


Figure 1A. Early postoperative radiograph of the PEEK cage placed after cervical discectomy taken within the first 24 hours postoperatively.

Figure 1B. Cervical radiograph taken on the 60th postoperative day shows that the cage has collapsed and the cage is embedded in the adjacent vertebra.

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The total 100 patients are included and divided into 2 groups as those with and without cervical cage collapse at the 60th day control. The early postoperative cervical radiographs of

each of the patients were scanned within the first postoperative day and the loss of endplate brightness in the cervical vertebrae adjacent to the cage was examined (Figure 2).

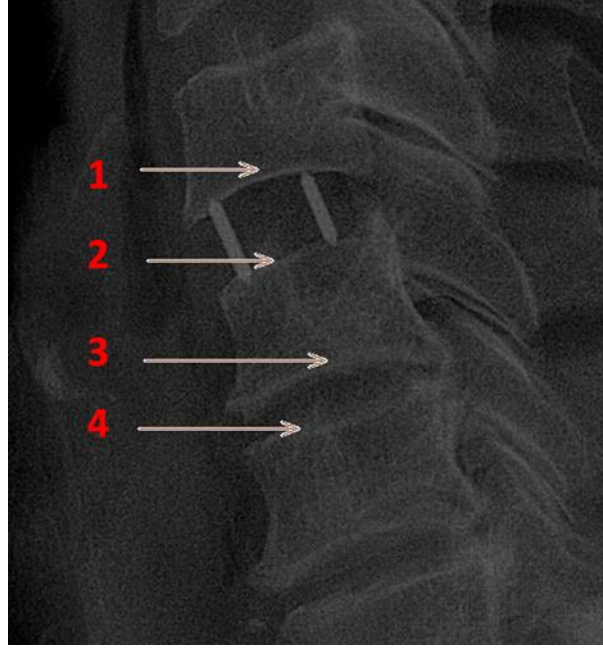


Figure 2. Early postoperative cervical radiograph of a patient with cervical cage collapse on postoperative day 60 control radiograph. In the vertebral endplates shown with arrows numbered as 1,3,4, cortical brightness is clearly seen, while the endplate shown with number 2 shows loss of cortical brightness.

The correlation between loss of endplate brightness on early postoperative radiographs and cervical cage collapse on postoperative day 60 radiographs was investigated.

For the analysis of the categorical data set, SPSS version 22.0 software program for

Windows was used along with Chi-square test. The results were evaluated at 95% confidence interval and $p < 0.05$ was considered significant.

This retrospective CT study was approved by the Clinical Research Ethics Committee of Ankara University (Confirmation Number: I06-392-23, Date: 20/06/2023)

RESULTS

One hundred patients (59 males, 41 females) who underwent cervical discectomy plus fusion with PEEK cage were included into the protocol. The control cervical radiographs of these patients taken on the 60th postoperative day were analyzed, and it was determined that 11 patients (11%) developed cervical cage collapse and 89 patients (89%) did not develop cervical cage collapse. The mean age of the 11 patients (8 males, 3 females) who developed cervical cage collapse was 42.5 years (42.5± 6.9). The mean age of 89 patients (51 males, 38 females) who did not develop cervical cage collapse was 41.5 (41.5± 8.6).

Early postoperative cervical radiographs of these patients taken within the first 24 hours after surgery were analyzed. 18 (18%) of 100 patients had loss of brightness in at least one end plate adjacent to the cervical cage on early cervical radiographs. While 10 (11.2%) of 89 patients who did not develop cervical cage shrinkage had loss of endplate brightness, 8 (72.7%) of 11 patients who developed cervical cage collapse had loss of endplate brightness.

These results point out that there is a strong correlation between the loss of endplate brightness detected on early radiographs and cervical cage collapse in later follow-ups, and the rate of cervical cage collapse is higher in those with endplate brightness loss ($p<0.001$).

DISCUSSION

Cervical discectomy and fusion following an anterior cervical approach is currently the gold standard method for the treatment of degenerative cervical disc disease (6). However, in the long-term follow-up of these surgeries, complications such as displacement of the cages placed in the disc space for fusion, embedding into adjacent vertebrae, dislocation and consequently failure to develop fusion are frequently encountered (6, 10). In case of these complications, axial pain occurs as a result of spinal canal compression, nerve root compression and instability.

The embedment of a cage placed between two cervical vertebrae into the adjacent vertebra following cervical discectomy is called cervical cage collapse. Several methods have been described in the literature for the radiologic diagnosis of cervical cage collapse, one of which is a cervical segment collapse of more than 2 millimeters on a follow-up radiograph compared to a radiograph taken immediately after surgery (6). It should also be noted that such a cage collapse and embedment is often accompanied by a segmental kyphosis at the same level (11).

In the literature, many risk factors directly related to cervical cage collapse have been identified (12). Incorrect surgical technique and inappropriately sized cage selection, which may cause excessive distraction of the disc space, are the main risk factors (12,13). Improper preparation and

advanced curettage of the vertebral endplate is also a risk factor for cervical cage embedment and collapse (14). In addition, the presence of severe osteoporosis and the location of the surgical level between the 6th and 7th cervical vertebrae have also been pointed out as risk factors for cervical cage collapse (15,16). Moreover, research on implant selection indicates that cervical cage collapse occurs more frequently with titanium cages than with PEEK cages (17), due to the lower modulus of elasticity in PEEK cages. This results in a closer elasticity match to the adjacent cortical bone (18).

In order to prevent cervical cage collapse, the use of a cervical plaque in addition to a cage placed following discectomy has been considered and its results have been investigated (5). There are studies showing that cage collapse and embedment are less common when a cervical plaque is used (19,20). Besides, it has been shown that if the surgery is performed by placing a plate in addition to cage placement, the rate of fusion formation increases and the duration of fusion formation is shortened (21). In consideration of all these, it is recommended to use a cervical plaque as an additional adjunct to the cage, especially in cases where the removal of the last plate during surgery is highly recommended (5).

In this study with 100 patients, we found that the rate of cervical cage collapse was significantly increased in the case of loss of brightness of the end plate in the cervical radiograph taken in the early postoperative

period, which is a finding that may be a warning sign for cervical cage collapse, and we concluded that the follow-up interval of these cases should be more frequent, and they require close monitoring and examination. The limitations of this study are that the total number of study population is relatively small, and the diagnosis of cage collapse was made with the radiograph taken on the 60th day after surgery. However, more meaningful results will be obtained in studies with larger patient groups and longer follow-ups.

CONCLUSION

There is a correlation between loss of cortical brightness in the endplates of the vertebrae adjacent to the cage on cervical radiographs taken after cervical discectomy surgery and the development of cervical cage collapse in follow-up, and cervical cage collapse is encountered more frequently. Therefore, the cervical radiograph taken in the early postoperative period should be carefully examined, the cortical brightness of the endplates of the vertebrae adjacent to the cage should be evaluated, and patients with a high probability of cage collapse should be followed up more closely and, if necessary, with a shorter follow-up interval.

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