

# Three-Level Cervical Discectomy and Fusion Without Internal Fixation

## İnternal Fiksasyonsuz Üç Seviyeli Servikal Diskektomi ve Füzyon

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**Abstract:** It is generally believed that the rate of pseudoarthrosis rises as the number of operative levels of anterior cervical discectomy and fusion increases. This retrospective study evaluated bone union status in 13 patients who underwent three-level anterior cervical discectomy and fusion with the Cloward technique. No allografts or internal fixators were used in any of the procedures. Pseudoarthrosis developed in four patients, each with one level affected, and three of these individuals were cigarette smokers. None of the 13 patients needed subsequent surgery, and there were no major postoperative complications. The Cloward technique is effective for three-level anterior cervical discectomy and fusion, but the associated 30% pseudoarthrosis rate in the group of patients in this study was unacceptable. In all cases, the cervical level that developed pseudoarthrosis was the lowest motion segment that had been operated.

**Key words:** Anterior cervical discectomy and fusion, autograft, internal fixation, pseudoarthrosis

**Özet:** Genellikle anterior servikal diskektomi ve füzyon seviye sayısı arttıkça psödoartroz oranının arttığı kabul edilmektedir. Bu retrospektif çalışmada üç seviyeli anterior servikal diskektomi ve Cloward tekniği ile füzyon yapılan 13 hastada kemik birleşmesi değerlendirilmiştir. Ameliyatların hiçbirinde allogreft ya da internal fiksator kullanılmamıştır. Dört hastada her birinde birer seviye olmak üzere psödoartroz gelişmiştir ve bu hastalardan üçü sigara kullanıyordu. 13 hastadan hiçbirinde ikinci bir ameliyata gereksinim duyulmamış ve hiçbirinde major postoperatif komplikasyon görülmemiştir. Üç seviyeli anterior diskektomi ve füzyon için Cloward tekniği etkin bir yöntemdir, fakat bu grup hastada görülen % 30 oranındaki psödoartroz oranı kabul edilebilir değildir. Psödoartrozis dört olguda da opere edilen en alt hareket segmentinde oluşmuştur.

**Anahtar kelimeler:** Anterior servikal diskektomi ve füzyon, internal fiksasyon, otoplast, psödoartroz

### INTRODUCTION

Anterior cervical discectomy and fusion is a widely accepted method of treating symptomatic disc herniation and degenerative disorders of the cervical spine (1,2,7). It can be difficult to achieve good results in individuals who undergo multiple-level surgery because these patients are at high risk for developing

pseudoarthrosis. Although not all pseudoarthroses are symptomatic, the overall outcome is superior when solid fusion is achieved. We prefer to use the Cloward technique because of our familiarity with this method for fusion operations. In this study, we analyzed our results in patients who underwent the Cloward surgical technique for three-level anterior discectomy and fusion, and assessed the quality of

vertebral fusion and overall outcome in this group.

### PATIENTS AND METHODS

Between 1992 and 1996, 60 patients at our center underwent surgery for cervical disc herniation. Of these patients, 44 had one-level, 2 had two-level, and 14 had three-level herniation. One of the 14 three-level operated patients was lost to follow-up, thus our series included 13 patients, specifically 7 males and 6 females. The mean patient age was 51.5 years (range, 21 to 72 years). Although all 13 individuals complained of neck and arm pain that did not respond to conservative treatment, their main clinical problems at presentation were radiculopathy in 8 patients, and cervical spondylotic myelopathy in 5 patients. None of the patients had had previous surgery in the cervical region. Three individuals were cigarette smokers.

Prior to 1994, we evaluated four patients using computerized tomography, but magnetic resonance imaging was used to assess the nine most recent patients. We documented all herniated discs and/or osteophytes preoperatively by one or the other of these methods. Anterior cervical discectomy and fusion were performed using the Cloward technique at all levels in all patients, with autografts harvested from each patient's iliac crest. No allografts or internal fixators were used. We obtained immediate postoperative radiographs to confirm that the grafts were correctly positioned. Each individual wore a rigid cervical collar for 8 weeks postoperatively, and patients were followed clinically and radiologically for a mean of 41.3 months (range, 22 to 72 months).

Pre- and postoperative pain status was graded as mild, moderate, or severe, in accordance with Robinson's criteria (7). In all patients, radiographic fusion was determined based on plain lateral cervical radiographs and flexion-extension views. The criteria for fusion were bridging of the disc space with trabecular bone, and 1 mm or less change measured between spinous processes on flexion-extension views.

The disc pathology documented at the 39 cervical levels that required surgery was as follows: posterior protrusion of the disc (22 levels), extrusion of a disc fragment below the posterior edge of the vertebra (8 levels), and herniation of disc material through the posterior longitudinal ligament (9 levels).

### RESULTS

The eight patients with radiculopathy recovered full motor function postsurgery, and none experienced worsening of their neurological symptoms. In addition, none of these patients developed cervical disc herniation at any other level in the postoperative course. Two patients were dysphagic in the immediate postoperative period, but this resolved within 2 weeks of the surgery. There were no cases of wound or graft infection. Seven of the eight patients experienced pain at the donor site, but this resolved before suture removal in all cases. There was no graft displacement, and none of the patients needed further surgery.

Of the 13 patients in this series, 9 developed solid fusion at all operated levels. Seven of the nine became symptom-free, and two patients experienced occasional mild cervical pain during follow-up, but this did not cause any significant functional limitation (Figure 1). Four of the 13 patients were diagnosed with pseudoarthrosis, with one level affected in each individual (Figure 2). We noted that three of the four patients with pseudoarthrosis smoked prior to and following their operations, but the small number of patients in this series was insufficient for statistical analysis of any possible association between smoking and pseudoarthrosis (Table 1). In each case, pseudoarthrosis developed at the lowest motion segment that had been operated. Two of the four individuals with pseudoarthrosis had mild pain, one had moderate pain, and one was asymptomatic.

### DISCUSSION

Anterior cervical discectomy and fusion are widely accepted as safe and effective treatment for cervical disc herniation and cervical spondylosis. With regard to clinical outcome, pain resolves first, then motor function returns, and sensory function is restored last (2). In addition to removing herniated discs and bone spurs, the aim of these procedures is to achieve bone union at every level of vertebral fusion. Creating a solid arthrodesis is considered vital to obtaining good results with fusion surgery (6). If the fusion fails and pseudoarthrosis develops, the usual outcome is long-term pain.

Patients who undergo these procedures must be followed until radiological studies confirm bone union. The use of lateral flexion and extension radiographs is advised for assessing union because, although plain lateral radiographs may indicate solid

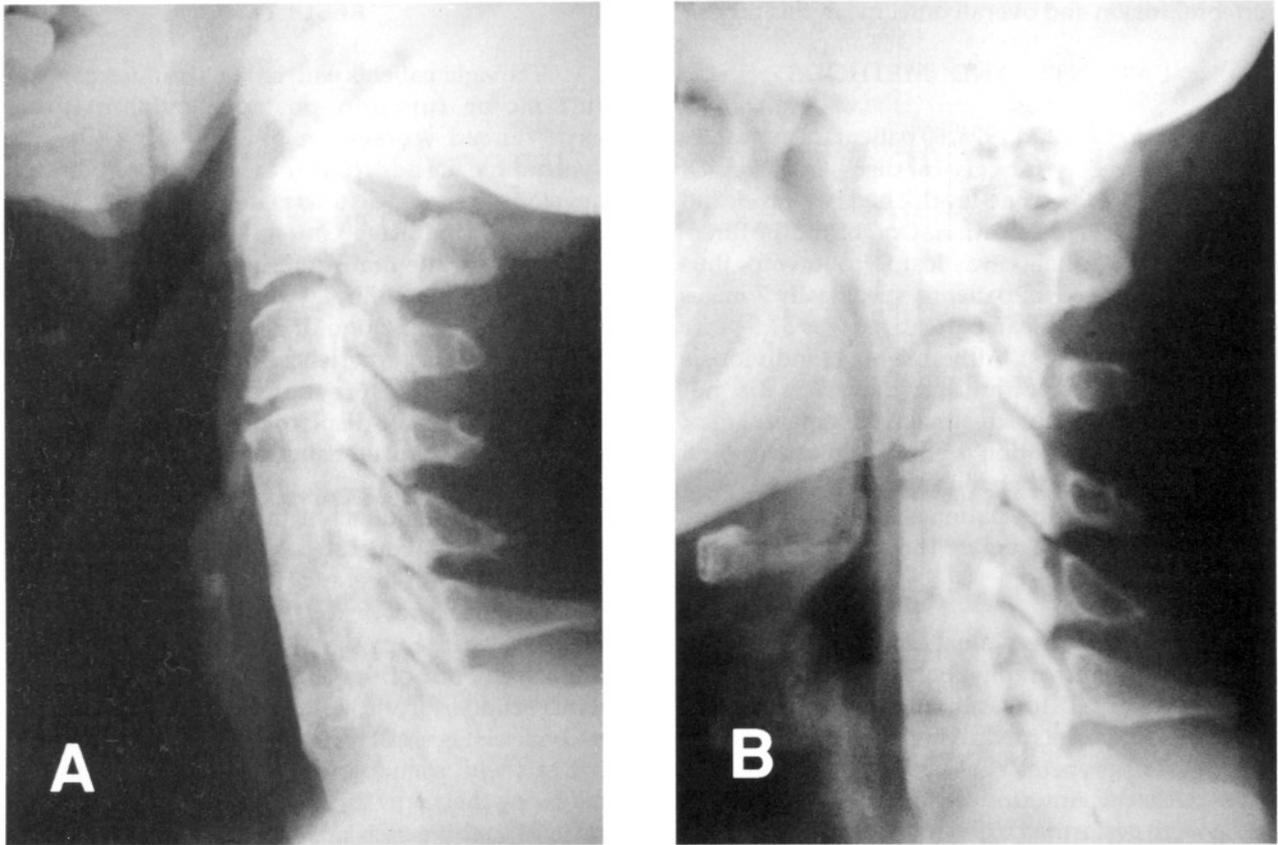


Figure 1: A patient's lateral hyperextension (a) and hyperflexion (b) radiographs show solid fusion at all three operated levels.

Table I: Age (years) and gender, clinical presentation, levels operated, follow-up periods (months) and pseudoarthrosed levels of patients.

| Patient No. | Age & Gender | Clinical Presentation | Operated Levels | Follow-Up Period | Pseudoarthrosis Level |
|-------------|--------------|-----------------------|-----------------|------------------|-----------------------|
| 1           | 46 M*        | R                     | C 3-4,4-5,5-6   | 34               | C 5/6                 |
| 2           | 42 F         | R                     | C 4-5,5-6,6-7   | 72               | -                     |
| 3           | 58 F         | SM                    | C 3-4,4-5,5-6   | 26               | -                     |
| 4           | 38 F         | R                     | C 3-4,4-5,5-6   | 42               | -                     |
| 5           | 44 M         | R                     | C 3-4,4-5,5-6   | 22               | -                     |
| 6           | 61 F*        | SM                    | C 4-5,5-6,6-7   | 45               | C 6/7                 |
| 7           | 72 M         | SM                    | C 3-4,4-5,5-6   | 36               | -                     |
| 8           | 66 M*        | R                     | C 4-5,5-6,6-7   | 39               | C 6/7                 |
| 9           | 51 F         | R                     | C 4-5,5-6,6-7   | 42               | -                     |
| 10          | 71 M*        | SM                    | C 3-4,4-5,5-6   | 55               | -                     |
| 11          | 21 M*        | R                     | C 3-4,4-5,5-6   | 38               | -                     |
| 12          | 42 F         | R                     | C 3-4,4-5,5-6   | 26               | C 5/6                 |
| 13          | 58 M         | SM                    | C 3-4,4-5,5-6   | 60               | -                     |

Abbreviations\*: smoker, R: radiculopathy, SM : spondylitic myelopathy.



Figure 2: A lateral radiograph of a patient demonstrates solid fusion at the upper two levels, and pseudoarthrosis at the third level at which surgery was performed

fusion, lucency can often be detected at the vertebral interface. Further, long-term follow-up is important, since some authors have reported that fusions that appeared solid on radiographic studies done 3 to 4 months postsurgery later developed pseudoarthroses (2).

A number of factors are thought to influence the success of vertebral fusion surgery. Brown et al. demonstrated in their series that the lumbar fusion rate in smokers was statistically lower than that in nonsmokers (3). In their prospective series of 132 anterior cervical interbody-fused patients, Bishop and colleagues found that cigarette smoking was detrimental to successful bone fusion (1). As mentioned, three of the four patients with fusion failure in our series were smokers. We advised these individuals to stop smoking as soon as possible, and stressed the importance of doing so at least, after the surgery. Regarding other influences, as Table 1 shows, two of our four pseudoarthrosis patients were

males, and we found no significant difference between the pseudoarthrosis group and the rest of the 13 patients in the series with regard to age distribution. It appears that smoking is the only factor that we can control preoperatively which is known to have a negative influence on pseudoarthrosis.

In their retrospective study, Bohlman and coworkers found a positive correlation between the number of operated levels and the rate of pseudoarthrosis. Although they stated that multiple vertebrectomy and one long strut graft fixed in place following multiple level discectomy might lower the number of healing surfaces and reduce problems with pseudoarthrosis, neither their team nor ours chose to attempt this technique (2). Emery et al. suggested that the number of operative levels should not affect the local blood supply because of the highly vascular nature of the vertebral body. It is likely that altered biomechanics plays the most important role at graft-body interfaces when the number of operative levels is relatively high (5).

As an alternative to the procedure we use, the Robinson technique is also a popular method, but we have performed the Cloward technique safely for 15 years without any major complications. Anterior cervical fixation has been suggested as an effective option for multiple-level operations (4). Regarding postsurgical assessment, the follow-up period for these patients must be long enough to confirm solid fusion, but it seems reasonable to accept x-ray confirmation of bone union as the last necessary recheck.

## CONCLUSION

Although use of the Cloward technique without internal fixation is perhaps not the ideal procedure for multiple-level fusions, we have used this method safely and successfully for three-level anterior cervical discectomy and fusion. The clinical problems in our patients who developed pseudoarthroses were so mild that no further surgery was required. It is essential that every patient be followed until solid fusion is confirmed at all operated levels, but we suggest there is no need to continue with further rechecks in asymptomatic patients. In addition to the need to confirm bone union, close follow-up is required to monitor for common complications, such as infection and deformity.

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