The Journal of Turkish Spinal Surgery
2010; 21 (2): 163-170

CASE REPORT / *OLGU SUNUMU*

MIGRATION OF BANANA-SHAPED CAGE IN THE TWO LEVELS AFTER POSTERIOR LUMBAR INTERBODY FUSION: A CASE REPORT

İKİ SEVİYE POSTERİOR LOMBER İNTERVERTEBRAL FÜZYON SONRASI MUZ-KAFES MİGRASYONU: OLGU SUNUMU

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SUMMARY:

Interbody fusion with cage is an effective treatment modality which showed good results in treating this instability due to spondylolytic spondylolisthesis. However, recent studies showed major complications of this technique. In this report, the authors present the first case of banana-shaped cage migration in the two adjacent levels. A 32-year-old woman, who was operated for Grade II spondylolisthesis of L5 vertebra with posterior lumbar interbody fusion (PLIF), by banana-shaped cages placed in L4-5 and L5-S1 intervertebral disc spaces. After 2 months of the operation, the patient complained severe low back pain radiating to both legs. Control lumbar imaging showed dislocation and migration of the both cages posteriorly obliterating the spinal canal. The patient was then operated by posterior approach, with removing the migrated cages, interbody fusion with autologous iliac graft and posterior fixation with rods and pedicle screws. The patient's complaints resolved completely, and discharged with no further complications.

Keywords: *Cage migration, complication, posterior lumbar interbody fusion, spondylolysthesis*

Level of Evidence: *Case report, Level IV.*

ÖZET:

Spondilolitik spondilolistezise bağlı gelişen instabilite tedavisinde kafes ile intervertebral füzyon uygulamasında iyi sonuçlar elde edilmiştir. Ancak, son çalışmalarda bu tekniğin majör komplikasyonları gösterilmiştir. Bu yazıda, yazarlar iki komşu seviyede uygulanan ilk muz-kafes migrasyonu olgusu sunmaktadır. 32 yaşında kadın hasta L5 vertebrada grade II spondilolistezis nedeniyle L4-5 L5-S1 seviyelerine muz-kafes yerleştirilerek posterior intervertebral füzyon ile tedavi edilmiştir. Ameliyattan 2 ay sonra, hasta her iki bacağına yayılan şiddetli bel ağrısı şikayeti ile başvurdu. Yapılan görüntülemelerde her iki seviyeye yerleştirilen muz-kafesin migrasyonu ve buna bağlı spinal kord basısı saptanmıştır. Hasta posterior yaklaşım ile opere edilerek migre olan kafesler çıkartılıp otolog iliak greft ve pedikül vidaları ile posterior tespit uygulanarak intervertebral füzyon yapılmıştır. Ameliyat sonrası dönemde hastanın şikayetlerinde düzelme saptanıp komplikasyon olmadan taburcu edilmiştir.

Anahtar Kelimeler: *Kafes migrasyonu, komplikasyon posterior lomber cisimler arası füzyon, spondilolistezis.*

Kanıt Düzeyi: *Olgu sunumu, Düzey IV.*

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INTRODUCTION:

Since Brantigan and Steffee first described the use of interbody implants in 1933 [1], and reported successful fusion in their series, many articles considering biomechanical tests and clinical studies of interbody fusion cage were published, and the biomechanical advantage and clinical safety and effects were impressive [14]. However, only a few studies have been performed to review and analyze their complications, and most of them were in the form of case reports [6, 16]. These complications include cage migration into the adjacent vertebral bodies and dislocation into the spinal canal, with dural tears.

In this report, the authors present a case of migration of banana-shaped intervetebral cage in the two levels in the same patient. To our best knowledge, this is the first reported case of banana-shaped cage migration after PLIF, in contrast to the reported migrations of strait cages, which are more commonly reported.

CASE REPORT:

A of 32-year-old woman, with the history of low back pain radiating to both legs for 5 months, which did not response to medical treatment and physical therapies. Lumbar X-rays revealed grade II spondylolytic spondylolisthesis of L5, with narrowing of the spinal canal and nerve roots at this level, with mobility of the slipping vertebra and instability in dynamic graphies. Lumbar MRI revealed grade II spondylolytic spondylolisthesis of L5, with narrowing of the spinal canal and nerve roots at this level. The patient was operated in different center with left L5 hemilaminectomy and microdiscectomy, followed by placement of expandable banana-shaped cages (SmArtCage-L®, SmartSpine Inc., France) in L4-5 and L5-S1 intervertebral disc spaces (PLIF). In the early postoperative period the patient's symptoms showed regression. However, the patient complained severe low back pain radiating to both legs after 2 months and refered to our department. Lumbar X-rays, computed tomography (CT) scan and magnetic resonance imaging (MRI) showed dislocation and migration of the both cages posteriorly obliterating the spinal canal (Fig.1 and 2).

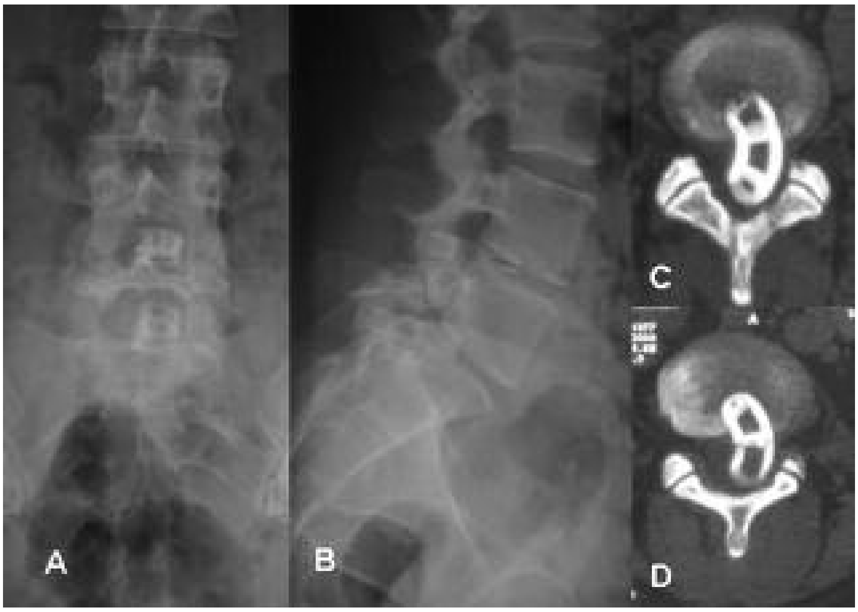

Figure-1. Lumbar radiologic investigations of the patient obtained when after PLIF, demonstrating dislocation and migration of the both cages posteriorly obliterating the spinal canal. a. P-A lumbar x-ray, b. lateral lumbar X-ray, c. axial CT scan of L4-5 intervertebral space, and d. axial CT scan of L5-S1 intervertebral space.

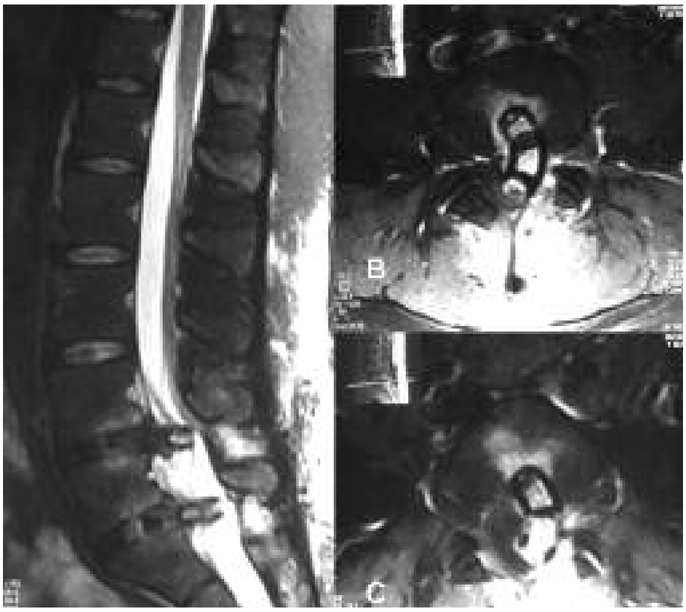

Figure-2. Lumbar MRI of the patient obtained when after PLIF, demonstrating dislocation and migration of the both cages posteriorly obliterating the spinal canal. a. sagittal T2-weighted image, b. axial T2-wighted image of L4-5 intervertebral space, and c. axial T2-weighted image of L5-S1 intervertebral sapce.

The patient was then prepared for operation. In prone position, after exposing L4, L5 and S1 levels, L5 laminectomy was performed and dura was exposed. The dura was tight and bulging, and the cages were not visible, however, due to the severe cage compression upon the dura, the cages were palpable over the posterior dura of the spinal cord. The dura was extensively adherent by newly formed fibrous bands to the cages. Dural dissection was done under the operating microscope, and the cages were exposed. The cages were very adherent to the intervertebral disc space, because of the formation of fibrous bands between the cages and the disc spaces, through the numerous holes of the cage. Removing the stuck cage was difficult, and dangerous in this stage. These fibrous bands were dissected individually under the operating microscope, therefore mobilizing of the cages was then facilitated and removed in en bloc fashion. During removing one of the cages, tear of the adherent dura occurred, and CSF leakage was observed. Dural defect was then sutured and sealed with Tissel® fibrin glue (Baxter Healthcare Corporation, Deerfield, IL). Autologous iliac crest grafts were inserted into the disk space, and posterior fixation was applied by rods and pedicle screws in L4, L5 and S1 levels.

In the postoperative period the patient's complaints showed regression, and the follow-up radiologic investigations showed decompression of the spinal canal and nerve roots, with improvement of the lumbar alignment (Fig.3). The patient was then mobilized with external brace, and was discharged afterwards, with no further complications.

Figure-3. Postoperative lumbar x-ray demonstrating posterior fixation with rods and L4, L5 and S1 pedicle screws, with decompression of the spinal canal and nerve roots, with improvement of the lumbar alignment.

DISCUSSION

Spondylolytic spondylolisthesis is a common cause of spinal instability. Interbody fusion with cage showed good results in treating this instability, due to the advantageous features of this technique, such as restoration of load bearing capacity to the ventral spinal column, maintenance of intervetebral disc height, distraction of intervetebral foramen and immediate stabilization [2].

Posterior lumbar interbody fusion (PLIF) was pioneered in the 1940s by Cloward to treat degenerative disc diseases and produced good results [5]. However, PLIF has never been accepted generally because of its technical difficulty. Since Brantigan and Steffee first described the use of interbody implants in 1993 [1], and reported successful fusion in 26 patients, a series of biomechanical tests and clinical studies of interbody fusion cage were published, and the biomechanical advantage and clinical safety and effect were impressive [14]. Despite the growing clinical interest in fusion cages, only a few studies have been performed to review and analyze their complications, and most of them were in the form of case reports [6, 16]. Major complications such as cage migration into the adjacent vertebral bodies and dislocation into the spinal canal, with dural tears are described in these reports.

There are several factors that can cause cage migration [3]. Severe obesity of the patient or reduced load-bearing capacity of the vertebral endplates due to low bone mineral density can increase the risk for implant migration [12]. Cage position is an importact factor concerning cage migration. In general, the lumbar and sacral posterior endplate regions are stronger than the anterior ones, and the lumbar lateral regions are stronger than the central ones. The strongest region is located postero-laterally, just in front of the pedicles, with more than twice the strength of the central endplate. Moreover, biomechanical studies showed that a dorsolateral placement of interbody cages in combination with a pedicle screw system results in a 20 % higher failure loads than a central cage placement, although the results were not statistically significant [3,11]. Endplate preparation techniques have also an important influence on cage dislocation. The importance of preserving the endplates to prevent cage migration has been emphasized by several authors [10, 12]. However, because preserving the vertebral endplate provides only a minimal mechanical advantage [9], other authors recommended complete removal of the bone endplate to allow better fusion [8, 13].

The endplate morphology and the size, shape, and elasticity modulus of cages can also affect cage migration. Deeply concave or other forms of irregularly shaped endplates as well as a small cage size reduce the contact area between the cage and the bone surface. The smaller the surface contact area, the higher the stress on the endplate [4, 7-9, 12]. A cadaveric study demonstrated significant higher failure loads when the cages covered 40 % of the endplate surface area opposed to 20% [15].

Inspite of these reports presenting migration of intervetbral cage after PLIF, all these reports included strait cages. Only few articles in the literature described banana-shaped cage [3], and to our best knowledge, no case of banana-shaped cage migration after PLIF is reported. Banana-shaped cages are used in posterior ond transforaminal lumbar interbody fusions (TLIF and PLIF). The bent configuration (banana-shaped) is designed to facilitate the insertion of the cage from the posterior or posterolateral side of the intervetebral disc space with some rotation, to be positioned in the center of this space (Fig.4). Our case represents the first reported case of banana-shaped cage migration after PLIF. Moreover, our case demostrated migration of 2 cages in 2 adjacent levels.

Additional posterior instrumentation found to be important in stabilizing the cage and increase the rate of successful fusion. Although early recommendations for PLIF application described additional posterior enstrumentaion to be of benifit, but not necessary, in a study of Chen et al. on spondylolisthesis treated with PLIF using BAK cages with a follow-up of more than 2 years, cage migration was seen in 16.7 % (subsidence 9.5 %, retropulsion 7.2 %) of the cases with no additional posterior instrumentation (as in our case), and in 0 % of

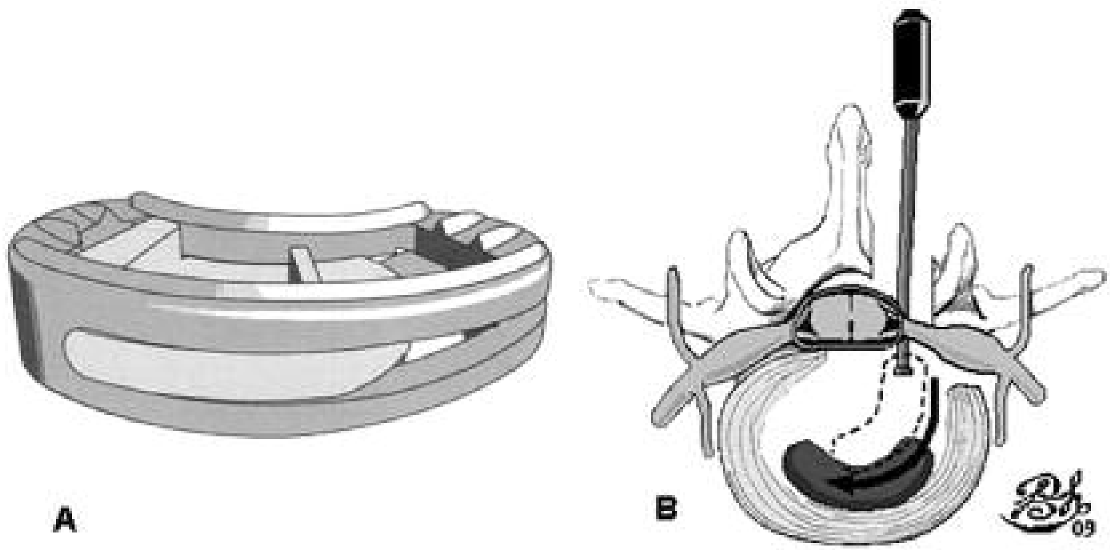

Figure-4. a. A photograph showing the configuration of banana-shaped cage. **b.** A drawing demonstrating the technique of banana-shaped cage insertion for PLIF.

the cases with additional posterior instrumentation [2]. In our case, we believe that the most the important cause of migration of the intervertebral cage is its application into 2 levels without additional supporting posterior instrumentation. According to the mentioned results of Chen et al, and the finding of our case, we advocate the use of additional posterior intrumentation with PLIF, especially when it is applied for more than one segment.

Unlike bone graft retropulsion, which usually can be drilled out or removed in a piecemeal fashion, fusion cage must be removed en bloc. Glassman et al successfully removed a dislocated cage through the anterior approach, and the patient reported resolution of symptoms 6 months after surgery [6]. However, as Glassman et al mentioned, it was an extensive surgical procedure, including partial vertebral body resection [6]. On the other hand, Chen et al. adopted a posterior approach to remove the cage, with successful removal of dislocated cages in 2 patients [2]. In our case, we preferred the posterior approach. Cage removal was attempted after 2 months of insertion. Unlike removal of cages in the early postoperative period, in our case; sufficient time for fusion and fibrous formation was passed, and as we expected, the dura was severely adherent to the cages, which required individual dissection of these bands. Otherwise, attempting to remove these cages by anterior approach may cause distraction of the adherent dura and the underlying spinal cord, with high risk of cord injury and postoperative neurologic deficits. The posterior approach was used in our patient, with successful removal of the cages.

Because of its advantageous features, posterior lumbar interbody fusion (PLIF) showed good results in treating the instability of spondylolisthsesis. However, major complications such as cage migration into the adjacent vertebral bodies and dislocation into the spinal canal, with dural tears can occur. We advocate the use of additional posterior intrumentation with PLIF, especially when it is applied for more than one segment. In such complications, we also adopt the posterior approach to remove the cage.

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