

POSTERIOR INTERBODY SPONDYLODESIS WITH CAGE IN THE SYSTEM OF LUMBAR OSTEOCHONDROSIS TREATMENT

LOMBER OSTEONEKROZ TEDAVİSİNDE KAFES İLE POSTERİOR CİSİMLER ARASI SPONDİLODEZ

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SUMMARY:

Titanium cage in combination with autologous bone can be used successfully for the different types of interbody spondylosis additionally to the other known implants. Owing to the holes located in the corpus of titanium cage there is contact between autologous bone and osseous tissue of the adjacent vertebrae. The favorable conditions have been created for formation of bone-metallic spondylosis. During the period from 2008 to 2010 the operations with use of titanium implants for posterior interbody spondylosis in combination with autologous bone graft were performed in 32 patients with diagnosis of lumbar osteochondrosis. Among them there were 13 (40.6 %) males, and 19 (59.4 %) females. The age of patients fluctuated from 18 till 61 years (average age 39,5 years). In the preoperative period there were performed common clinical, neurological, roentgenological, MRI, CT and MSCT investigations. For evaluation of the impaired functional ability the Oswestry Disability Index (ODI) and visual analog scale (VAS) scores were measured pre- and postoperatively. Roentgenographic parameters included posterior and anterior segments of interbody intervals before and after operation, as well as flexion-extension difference of the segmentary angle at a level of surgical intervention. The change of the segmentary

angle value at the position of flexion and extension by less than 5° was evaluated as confirmation of the stable spine segment and formation of interbody block. Before operation all the patients were measured horizontal mobility 8.1±1.3 mm, and segmentary angle was more than 5°.

Average preoperative VAS and ODI scores were 4.8 ± 0.5 and 68.27 ± 7.59 were impaired postoperatively. In the last control visit (18-24 months), average VAS and ODI scores were 0.8 ± 0.4 and 12.72 ± 4.49 respectively. Postoperative average segmentary angle at the level of intervention was not higher than 5° and was on the average 2.3±0.3°. The long-term postoperative results were studied in 18 patients. The results obtained were assessed as good in 25 patients, and satisfactory results in 7 patients. One patient had unsatisfactory result.

In the light of the results of the this study, the application of titanium cage has reduced traumatic effect of operation and has not required additional use of autologous bone tissue from the iliac crest were concluded.

Key words: Low back pain, posterior interbody fusion, titanium cage

Level of evidence: Retrospective case study, without statistical analysis, Level IV.

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ÖZET:

Cisimler arası spondilodez için bilinen implantlara ek olarak otolog kemik ile titanyum kafesler başarı ile kullanılmaktadır. Titanyum kafes üzerindeki deliklerden, kafes içindeki otolog kemik, komşu omurların süngerimsi kemiği ile temas halindedir. Beklenen durum, metal-kemik spondilodezinin sağlanmasıdır. 2008 ile 2010 yılları arasında, lomber osteokondroz tanısı olan 32 hastada posterior cisimler arası füzyon için otolog greft ile doldurulmuş titanyum kafesler kullanılmıştır. Hastaların 13 (%40,6)'ü erkek ve 19 (%59,4)'ü kadındır. Preoperatif dönemde hastalar klinik, nörolojik, MR, BT ve myelo-BT ile değerlendirilmiştir. Hastanın fonksiyonel değerlendirilmesi preoperatif ve postoperatif olarak Oswestry maluliyet indeksi (ODI) ve görsel analog skalası (VAS) ile yapılmıştır.

Radyolojik değerlendirme parametreleri ameliyat öncesi ve sonrası ekstansiyon ve fleksiyonda posterior ve anterior cisimler arası farkı ve cerrahi yapılan düzeydeki segmenter açı değerleridir. Segmenter açısındaki fleksiyon ve ekstansiyondaki değişiklik 5°'den az ise ölçüm yapılan düzeyde spinal stabilite

varlığı veya füzyon geliştiği düşünülmüştür. Ameliyat öncesi tüm hastalarda horizontal hareketlilik 8.1 ± 1.3 mm ve segmenter açılar ise 5°'den fazla olduğu saptanmıştır.

Ameliyat öncesi VAS ve ODI skorları 4.8 ± 0.5 ve 68.27 ± 7.59 olup, postoperatif belirgin olarak düzelmiştir. Son kontrolde (18-24 aylar arası) ortalama VAS ve ODI skorları sırasıyla 0.8 ± 0.4 ve 12.72 ± 4.49 olduğu belirlenmiştir. Ameliyat edilen düzeyde postoperatif ortalama segmenter açı değerleri 5°'den az olup, ortalama $2.3^\circ \pm 0.3^\circ$ 'dür.

Uzun dönem sonuçlar, 18 hastada çıkartılmıştır. 7 hastada mükemmel ve 25 hastada iyi sonuçlar elde edilmişken, 1 hastada sonucun kötü olduğu saptanmıştır. Bu çalışmanın verileri ışığı altında titanyum kafeslerin operasyonun travmatik etkilerini azalttığı ve ek olarak iliak kanattan alınan otolog greftlere ihtiyaç göstermeden spondilodezi sağladığı fikri elde edilmiştir.

Anahtar kelimeler: Bel ağrısı, posterior cisimler arası füzyon, titanyum kafes

Kanıt düzeyi: İstatistiksel çalışma içermeyen retrospektif olgu serisi, Düzey IV

INTRODUCTION:

The surgical treatment of various forms of lumbar osteochondrosis, for example, associations of instability of a segment with intervertebral disk herniation or degenerative stenosis, or vertebral spondylolisthesis, remain to be serious problem of the spine surgery ^(1,5,10,19-20).

A variety of clinical and pathomorphological manifestations of the degenerative spinal changes dictate necessity of differential approach to treatment of this pathology. Such approach should be based on principles of clinical-morphological conformity to the minimal surgical sufficiency ^(3,12-14,21-22). For elimination of the pathological conditions at this time there are applied various types of decompressive and decompressive-stabilizing interventions. There are anterior, posterior, posterior interbody and other types of spondylodesis ^(4,6-7,16-17). Because of great development and improvement of medical technologies the anterior spondylodesis concedes the place on back ^(1,8,11,15). The anterior spondylodesis according to the data of literature is known by its multiple complications ^(14,21).

The autologous bone graft, metal implants, ceramics, biopolymers and others are frequently used as plastic material. Because of slow reorganization of the autologous bone

graft, the long postoperative bed regimen is required ^(9,11,18).

The various implants made from titanium have been developed and manufactured by foreign firms for interbody spondylodesis ⁽²⁾. However, in any case these materials are foreign bodies and they are unable to be integrated with the body tissues. In order to preserve the achieved intervertebral intervals and to improve the quality of spondylodesis the metal implants should be combined with autologous bone graft.

The purpose of our research was to develop the native titanium implant for performance of the posterior interbody spondylodesis in combination with autologous bone graft at various types of decompressive-stabilizing operations for treatment of lumbar osteochondrosis.

MATERIAL AND METHODS:

In the beginning of 2007 together with Joint Stock of the air factory after V.P.Chkalov there was developed titanium implant for posterior interbody spondylodesis. In 2008 the Patent for useful model "The Device for treatment of damages and diseases of the spine" № (11) FAP 00398, (51) 8A61B 17/58, (21) FAP 2008 0005 from 22.01.2008 was received (Fig.-1).

The device for treatment of degenerative spinal lesions was made as hollow body from titanium alloy 1, one end of which has the form of cone 2, on the surface of device there is a groove 3, in the central part of the device there are holes of quadrangular form 4, in the middle of the opposite end there is a deepening of quadrangular form 5 and four holes 6.

Technique:

After detection of a zone of damage the affected site has been removed, the bed has been prepared for placement of the offered device with use of special crown mill in bodies of top and lower vertebrae. The device is

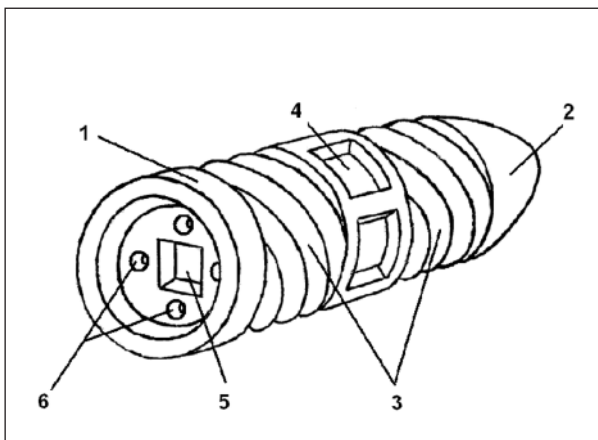


Figure-1. Interbody cage.

placed in the previously prepared bed. One end of cone form⁽²⁾ is introduced into this bed. On the opposite end into the deepening of quadrangular form⁽⁵⁾ the key of tetrahedral form is inserted for the device⁽¹⁾ with groove⁽³⁾ and cone⁽²⁾ to be screwed into the intervertebral interval. Through holes⁽⁶⁾ the cavity of device is filled with bone fragments (Fig.-1).

During the period from 2008 to 2010 the operations with use of titanium implants for posterior interbody spondylodesis in combination with autologous bone graft were performed in 32 patients with diagnosis of lumbar osteochondrosis. Among them there were 13 (40.6 %) males, and 19 (59.4 %) females. The age of patients fluctuated from 18 till 61 years (average age 39,5 years). In the preoperative period there were performed common clinical, neurological, roentgenological, MRI, CT and MSCT investigations.

The indications for operative treatment were clinically important pathomorphological changes in the spine including intervertebral disk hernia, degenerative spinal canal stenosis, instability of the spinal segment, degenerative spondylolisthesis, pain syndrome recurrence after extended decompressive operations. The decompressive-stabilizing operations with interbody spondylolisthesis were performed from the posterior approach at the following levels: L4-5 at 15 (46.8 %), L5-S1 at 14 (43.75 %), L1-2 at 1 (3.1 %) and L4-5-S1 at 2 (6.25 %).

The posterior lumbar interbody spondylolisthesis may be divided schematically into the following stages: 1- surgical access, 2- decompression of the nervous-vascular sites and autologous bone graft isolation from the vertebral arch, 3- bed formation for titanium cage and implant cavity filling with autologous bone graft, 4- cage insertion into the interbody interval, 5- suture of the surgical wound.

We agree with opinion of A.E.Simonovich (2005), that laminectomy with removal of the osseous and articular processes for formation of posterior interbody spondylodesis is not always justified. For performance of the posterior interbody spondylodesis the extended interlaminectomy with saving resection of the arch and articular process margins has been quite sufficient.

The implant height for implant is usually less than the cage size or height. On the average the cage diameter is from 16 up to 18 mm. The implant screwing results in increase of intervertebral space and, consequently, appearance of opening effect with wedge of interbody cage.

The posterior interbody spondylodesis in combination with transpedicular fixing was performed in 13 patients with establishment of expressed instability and lumbar segment degenerative spondylolisthesis (Fig.-2). In 19 cases the posterior interbody spondylodesis was performed with use two titanium cages (Fig.-3).

The bed regimen after operation stopped from 2 to 5 days, then the patients were permitted to walk. The external mobilization was provided with use of semihard corset during 3 months after operation.

The results of surgical treatment have been studied in 24 patients 3-6 months after operation and in 21 patients in 12-24 months. For evaluation of the impaired functional ability the Oswestry Disability Index was measured on a scale from 0 up to 100 %. The scores from 0 up to 20 % mean the minimal disorders, from 21 to 40 % - moderate, from 41 to 60 % - heavy, from 61 to 80 % - disability; 81 up to 100 % indicated about disorders arresting on bed. Formation of interbody block after spondylodesis was analyzed on the basis of parameters of roentgenographs, CT and MSCT. Roentgenographic parameters included posterior and anterior segments of interbody intervals before and after operation,

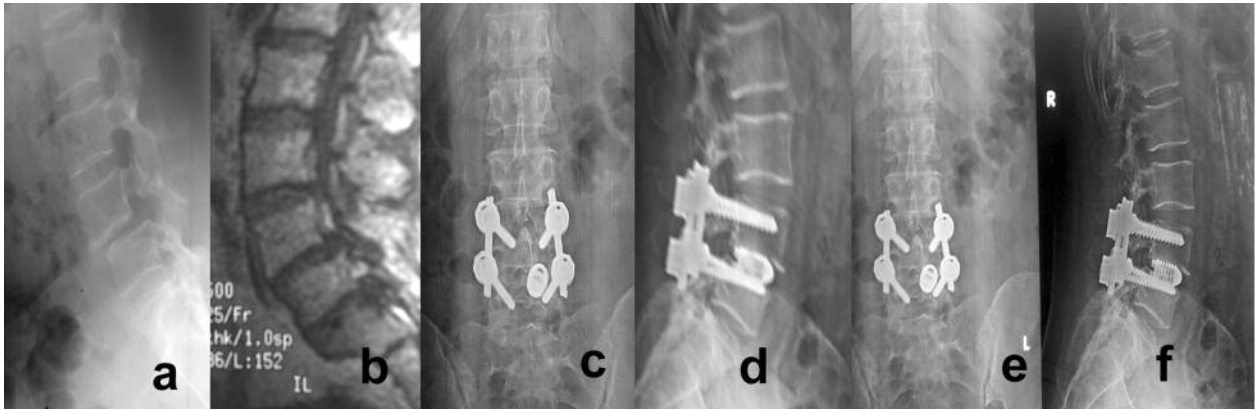


Figure-2. The radiologic findings of the patient E. (a) Preoperative lateral radiogram, (b) sagittal MR image, (c,d) postoperative P-A and lateral radiograms and (e,f) postoperative two years control radiographies of the patient with the degenerative spondylolisthesis L4-5 were seen. Formation of the interbody osseous-metal block was occurred.

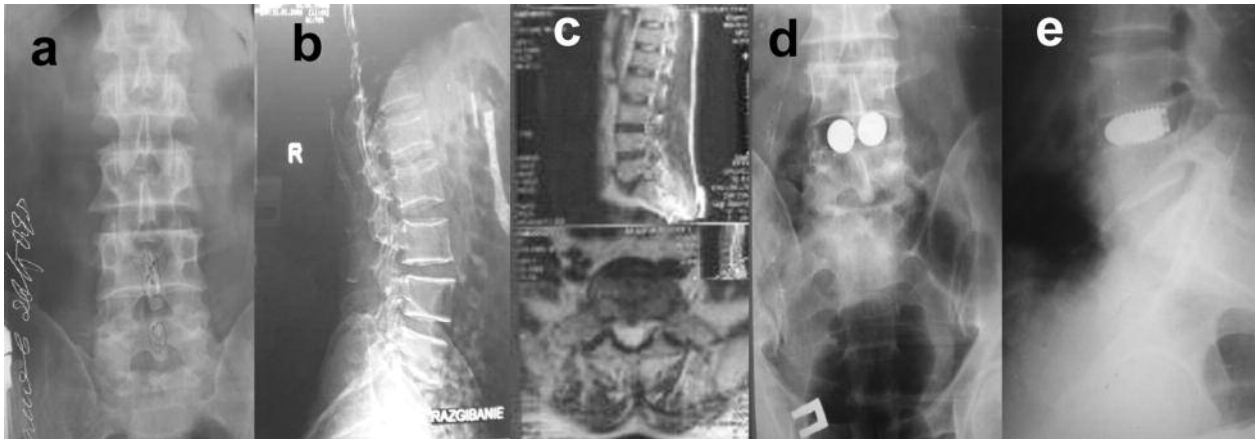


Figure-3. (a,b) Functional spondylograms, (c) sagittal and axial MR images, and (d,e) postoperative one year control radiographies of the patient P with discogenic instability at a level L4-5 because of the protrusion of a disk L4-5 and stenosis of the spinal canal was treated with posterior interbody spondylodesis with titanium cages.

as well as flexion-extension difference of the segmentary angle at a level of surgical intervention. The change of the segmentary angle value at the position of flexion and extension by less than 5° was evaluated as confirmation of the stable spine segment and formation of interbody block. Before operation all the patients were measured horizontal mobility 8.1 ± 1.3 mm, and segmentary angle was more than 5° .

The received results of surgical intervention we estimated with regards of a degree of

physical and social activity recovery of the patients. The criteria for estimation of the results of treatment were the following:

- Good result: complete or nearly complete returning to the former levels of social and physical activity.
- Satisfactory result: social and physical activity are restored not completely, small physical loadings are possible only.
- Unsatisfactory result: absence of effect from operation or deterioration of health state.

RESULTS:

The majority of patients felt sharp reduction of pain in the lumbar spine and lower extremities the next day after operation. Nobody of the patients there was noted increase in pain syndrome that indicated about adequate decompression of nervous-vascular masses and stabilization of vertebro-motor segment.

Regress of the pain syndrome were evaluated by 5 score visual - analog scale (VAS), it is shown in Table-1. Dynamics of Oswestry Index after performance of surgical intervention is presented in Table-2.

All patients underwent postoperative roentgenological, CT and MSCT examinations. Roentgenological investigations did not show implants destruction and signs of bone resorption around implant in the vertebra body in any case. The flexion-extension difference of the segmentary angle at the level of intervention was measured on the basis of roentgenological parameters. The data received indicated that an average parameter

of segmentary angle at the level of intervention was not higher than 5° and was on the average $2.3 \pm 0.3^\circ$.

The data of CT and MSCT investigations performed during the period from 12 months to 2 years indicated about implant stabilizing ability with formation of interbody bone-metallic block at the place of intervention (Fig.- 4,5).

Postoperative complications we divided into intraoperative and postoperative. Intraoperative period complications were characterized by frequent hemorrhages from varicose epidural veins in 8 patients. The hemorrhage was stopped by tamponade with use of hydrogen peroxide and very seldom with electrocoagulation. The partial damage of the dural sac was noted in 2 patients. This complication occurs during decompression of the degenerative changed spinal canal with use of the tool "Kerrinson", then parietal dural sac was damaged. The damaged site of the dural sac was closed by superficial flap from dorsolumbar fascia.

In the postoperative period there was no inflammatory process in any patient. It is

Table-1. Dynamics of the pain syndrome intensity by vas after operation

Operation	Before operation	Pain syndrome intensity by VAS from 0 to 5 scores		
		3	6-12	18-24
Posterior lumbar interbody spondylodesis with use of cage	4.8 ± 0.5 (n=32)	1.7 ± 0.2 (n=24)	1.2 ± 0.6 (n=21)	0.8 ± 0.4 (n=18)

Table-2. Dynamics of the oswestry disability index after surgical intervention

Operation	Before operation	Dynamics of the Oswestry Index in operated patients		
		3	6-12	18-24
Posterior lumbar interbody spondylodesis with use of cage	68.27 ± 7.59 (n=32)	19.37 ± 7.18 (n=24)	15.47 ± 4.21 (n=21)	12.72 ± 4.49 (n=18)



Figure-4. Degenerative instability L4-5 and sharp narrowing of the intervertebral joint were seen in (a,b) the frontal and lateral radiolograms (c) sagittal MR images and (d,e) postoperative AP and lateral radiographies of the patient C with Osteochondrosis of the lumbar spine, disk herniation of L3-4, L4-5.

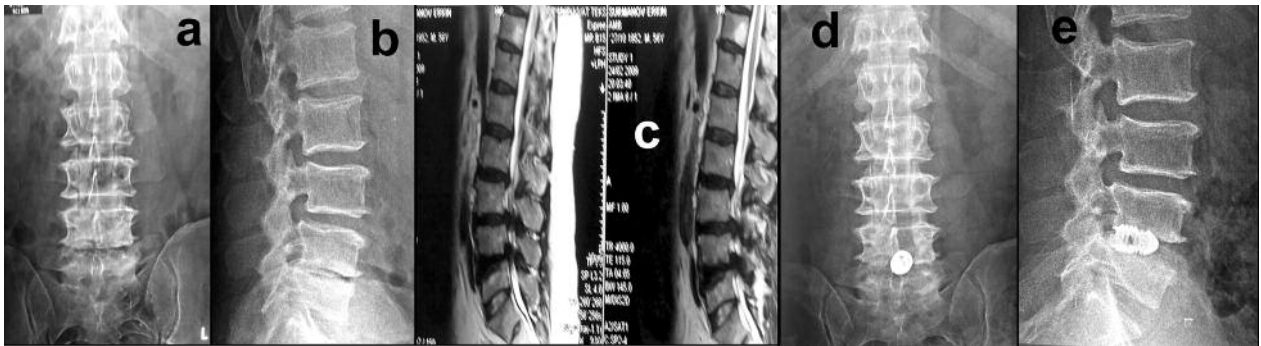


Figure-5. MSCT of the lumbar spine of patient Sh treated with transpedicular system and posterior interbody cage spondylodesis. Coating around the cage by bone tissue with formation of bone-metallic block were seen.

explained to that we used antibacterial agents of the wide spectrum of action before and during surgical interventions.

The long-term postoperative results were studied in 18 patients. The results obtained were assessed as good in 25 patients, and satisfactory results in 7 patients. One patient had unsatisfactory result. She underwent surgical interventions in the neurosurgical department in various hospitals in the republic. After decompressive-stabilizing operation in our clinic neurological parameters of the lower extremities were decreased a little, but during 6 months she is walking with the help of crutches. Because of rough scarry-adhesive changes in the spinal canal the reparative processes are slow.

DISCUSSION:

The results of posterior interbody spondylodesis with use of titanium cage in combination with autologous bone graft depended on the correct choice of surgical technique and adequacy of surgical intervention, directed to decompression of nervous – vascular formations and stabilization of spinal segment. High positive parameters indicated that titanium cages in a combination with autologous bone graft are quite met to many criteria being required from plastic material for stabilization of the spinal segment.

Roentgenological and MSCT investigations have not revealed destruction of the interbody

cages and their migration into vertebra. It was noted coating of the cage internal autologous bone graft with osseous tissue from adjacent vertebra with formation of the bone-metallic block. In all cases the operated spinal segments were stable. Besides the application of titanium cage resulted in decrease of traumatic operation effect and did not require additional use of auto-osseous tissue from the crest of the iliac bone.

The titanium cages in a combination with autologous bone graft may be successfully used for various types of interbody spondylodesis additionally to the other famous implants. Because of holes in the titanium cage body there is a contact between autologous bone graft and osseous tissue of the adjacent vertebra. The favourable conditions have been created for formation of bone-metallic spondylodesis. The application of titanium cage has reduced traumatic effect of operation and has not required additional use of autologous bone graft tissue from the iliac crest.

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