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ORIGINAL ARTICLE / *ORJİNAL ÇALIŞMA*

COMPARISION OF UNILATERAL POSTERIOR LUMBAR INTERBODY FUSION WITH SIMPLE DISCECTOMY AT DEGENERATIVE DISC DISEASE

DEJENERATİF DİSK HASTALIĞINDA BASİT DİSKEKTOMİ İLE TEK TARAFLI POSTERİOR LUMBAR CİSİMLER ARASI FÜZYON UYGULAMALARININ KARŞILAŞTIRILMASI

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SUMMARY:

Aim: *The aim of the study is evaluating the early results of unilateral posterior lumbar interbody fusion (UPLIF) technique with discectomy to prevent recurrence at degenerative disc disease (DDD) comparing with simple discectomy using visual pain scale (VPS).*

Material and methods: *Control group had 50 degenerative disc disease patients who underwent simple discectomy. In study group there were totally 42 patients, twelve patients had recurrent disc herniations, thirty patients had DDD. In this group polyetheretherketon (PEEK) cage was used for protecting the disc height and prevent recurrence. All patients were followed by the help of VPS and clinical exams and the groups were compared to each other statistically.*

Results: *In control group there is recurrences and postoperatively higher VPS scores. In the study group there's no recurrences and decrease of the VPS scores.*

Conclusion: *As a result of our study if the patient has degenerative disc disease then after discectomy using unilateral posterior PEEK cage and interbody grafting is a safer way for treatment of these kind of patients.*

Key words: *Degenerative disc disease, DBM putty graft, PEEK cage, Unilateral posterior lumbar interbody fusion.*

Level of Evidence: *Retrospective Clinical Study, Level III*

ÖZET:

Amaç: *Bu çalışmanın amacı visuel ağrı skalası (VAS) kullanılarak basit diskektomi ile unilateral posterior lomber interbody füzyon (UPLIF) tekniği ile dejeneratif disk hastalığının nüksünün engellenmesinin erken dönem sonuçlarının karşılaştırılmasıdır.*

Materyal ve metod: *Kontrol grubu basit diskektomi yapılan 50 olgudan oluşmaktaydı. Çalışma grubunda ise 12`si nüks disk herniasyonu, 30`u ise dejeneratif disk hernisi tanısı olan toplam 42 olgu yer aldı. Bu grupta nüksü önlemek ve disk yüksekliğini korumak için polietereterketon (PEEK) kafes kullanıldı. Tüm olgular VAS yardımı, klinik muayene ile takip edilerek gruplar istatistiki olarak birbirleriyle karşılaştırıldı.*

Sonuçlar: *Kontrol grubunda rekürrens ve potoperatif yüksek VAS skorları gözlendi. Çalışma grubunda ise rekürrens izlenmedi ve postoperatif VAS skorları düşüktü.*

Bu çalışmanının verilerine dayanarak, dejeneratif disk disk hastalığı olan hastalarda diskektomi sonrasında unilateral posterior PEE kafes ve interbody füzyon kullanımının güvenli ve başarılı bir yöntem olduğu fikri elde edilmiştir.

Anahtar Kelimeler: *Dejeneratif disk hastaligi, DBM puti greft, PEEK kafes, unilateral posterior lomber interbody fuzyon*

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INTRODUCTION:

In biomechanical respect posterior lumbar interbody fusion (PLIF), introduced by Dr.Ralph Cloward in the 1940's [5], is an optimal fusion. A succesful PLIF carries the advantages of immobilizing the unstable degenerated intervertebral disc area, decompressing the dural sac and nerve roots, restoring disc height and load bearing to anterior structures [3]. In spite of a lot of fusion techniques, such as autologous iliac crest bone graft, allograft bone, dowel-shaped graft, key stone graft, tricortical graft, and bone chips interbody PEEK cages preferred.

PLIF usually has been accomplished with implantation of two threaded cages [2]. The rate of fusion of bone grafts alone have ranged from 46 % to 90 % at the literature [4,8,15,17,20]. Because of difficulty in maintaining spinal stabilization and achieving fusion, spinal instrumentation has become an important and popular adjunct to bone grafting in lumbar arthrodesis, further increasing the fusion rates, 80-90 % [19].

More recently, interbody fusion techniques have also shown high fusion rates with distinct advantages [5,11-13,16]. Some of these advantages include immediate anterior column load sharing, a large surface area for fusion, bone graft subjected to compressive loads that is advantegous in achieving fusion and the ability to restore normal sagittal contour while indirectly decompressing the neuroforamen [11]. Interbody fusion technique also appear to be the most effective treatment of discogenic back pain unresponsive to conservative care [6,21].

Blume, in 1981, described an unilateral approach for PLIF to adress some of the potential complications of the standart PLIF such as root injuries, instabilization [2-3,18]. The unilateral PLIF popularized by Harms et al. is a surgical technique in which bilateral anterior column support can be achieved through a unilateral posterior approach [7].

Weatherly et al. reported on five patients during a 10 year period who had solid posterolateral fusions but still had positive discography under the fusion and had their back pain relieved by anterior interbody fusion [21]. All five patients had positive discograms and had pain relief after interbody fusion [21]. Recently, Derby et al. noted that patients with highly sensitive discs as determined by pressure controlled discography achieved significantly better long-term outcomes with combined anterior/posterior fusion [6].

Neverthless there are some problems followed by DDD operations such as recurrence, lost of height and instability. So, we planned to use a modified technique to prevent the recurrence of disc herniation and to protect the disc height. This modified technique consists of an unilateral posterior lumbar one interbody PEEK cage, because of large surface grafted easily by using demineralized bone matrix (DBM) putty graft.

PATIENTS AND METHODS:

Twenty six women and fifteen men with a mean age of 47.5 years (range 26-82 years) who underwent a UPLIF from October 2002 to December 2005. We used this technique to treat 42 patients with DDD and report the clinical and radiological results of minimum 36 months follow-up. During the same period 50 patients underwent to a simple discectomy for control group. Control group's mean age was 44.2 years (27 women and 23 men).

Every patient in study group have more than one year of disabling back pain with leg pain refractory to aggressive conservative treatment. Patients were asked to complete pre and

postoperative questionnaires assessing pain (medication use). The questionnaire was based on VAS (Table-1). A point system was used to categorize results as excellent (has no pain, unlimited daily activities), good (has pain if so tired or hard activities), fair (has pain if tired or long activities), unchanges (has no changes after operation) and poor (worse after operation) (Table-2). Previous lumbar surgery, smoking history, accompanying disease, working compensation and disability status were also recorded.

Tablo - 1. Comparison of the groups with pre and postoperative VAS values.

		PREOPERATIVE	POSTOPERATIVE	P VALUE
VAS	Control N=40	8.6	4.21	p<0.5
	Study group N=29	8.76	3.21	p<0.5

Tablo - 2. Postoperative evaluation of clinical situation of the groups.

	EXCELLENT	GOOD	FAIR	UNCHANGE	POOR
Control N=50	24	13	6	4	3
Study group N= 42	29	10	2	1	0

Follow-up period in the study group I averaged 45.5 months (range 36-64 months). In the study group, 30 patients underwent a single level UPLIF and 12 had two levels fused. All patients had DDD and in addition twelve had a recurrent disc herniation at different levels (6 at L5-S1 level, 5 at L4-L5 level, 2 at L3-L4 level, one patient had two level reccurency).

Surgical Technique:

The patient is placed on a spine frame in prone position with the hips in extension to maintain lumbar lordosis. Through standart midline approach the side of the spine selected for the UPLIF is based on preoperative symptoms. Once hemostasis is achieved with bipolar electrocautery and thrombin-soaked absorbable gelatin sponges or cottonoids, the underlying disc space, dural sac and nerve root should be readily seen. After retracting nerve root a 15-blade scalpel is used to create a rectangular window to annulus. The medial border of the window is lateral margin of the dural sac, and the lateral border is the lateral edge of the visible annulus. The incised annulus and degenerative disc material is removed. Cleaning upper and below end plates by curettes and after irrigating disc space with gentamycin containing saline, posterior lumbar Fidji PEEK cage (Spinenext-Bordeaux-France) (heights ranging from 8 mm to 12 mm) is placed to disc space. Before fixing it, is filled with DBM putty graft (Osteotech Inc.-New Jersey-USA).

Simple discectomy used for operating the control group patients.

All of the patients of study group are mobilized on postoperative first day and an external orthosis is used for the first month. At 6th weeks, progressive range of motion and strengthening exercises are initiated and at 6th months patients are allowed to perform impact and full activities. Following up is made at regular monthly intervals begining from the first month until the last control (36 months).

Radiographic Assessment:

Plain posterolateral and lateral standing radiographs including flexion-extension lateral views were obtained to evaluate disc height, segmental instability, sagittal profile and balance. Magnetic Resonance Image (MRI) and Computerized Tomography (CT) scans were obtained in each patient to document levels of

DDD and site of neural compression. Postoperatively plain radiographs including flexion-extension views were obtained in control visits to assess the progress of the fusion. A fusion was confirmed by progressive increase in interspace bone density and blurring of the adjecent endplates, presence of bridging posterolateral trabecular bone and no evidence of hardware failure, loosening, or motion on flexion-extension radiographs. At the end of three years we obtained all plain radiographs, CT and MRI of the patients again.

Statistical analysis:

Statistical evaluation was carried out using the program SPSS 13.0 for Windows. Student t test for independent cases were used for statistical analysis. Statistical significance was accepted for $p < 0.05$. A Bonferroni correction was calculated for each group of comparisons.

RESULTS:

Clinical Outcome:

Three patients did not come after two years follow-up period in study group. In study group pain level on a 10-point visual analog scale (VAS) improved from a preoperative mean value 8.7 to 2.8 (Student t test, $P< 0.05$) at latest follow-up (Table-1). No patients reported postoperative pain greater than their preoperative level in study group. Preoperatively all of the patients taking one or more non steroid antiinflammatory analgesic daily and postoperatively in the study group only one patient still take nonsteroidal antiinflammatory (NSAI) drug sometimes for pain. Thirty seven of patients in the study group (88.1 %) were rated excellent or good based on pre and postoperative questionnaire score that included combined pain and daily activity scores (Table-2) . Though only seven patients in the study group were able to work before treatment postoperatively all the patients returned to their work.

Radiographic fusion was thought to be present in 32 (76.2 %) patients based on the presence of the disc obliteration of the disc space anterior to the cages as well as continuous trabecular bone throughout the intervertebral fusion mass in the study group (Table-3). Two patients had subsidence of the cage and no patient need reoperation in the follow-up period in study group.

Tablo - 3. Comparison of the pre and postoperative complications of the groups.

	CONTROL (n:50)	**Study group (n:42)**
Lost of disc heights (>0.5 mm)	48 (96.0 %)	26 (61.9 %)
Dural tear	8 (16 %)	3 (7.14 %)
Recurrence	7 (14 %)	0 (0.0 %)
Postop.discitis	1 (2 %)	0 (0.0 %)
Intervertebral fusion radiological	----	34 (80.95 %)

In the control group there were seven recurrence (14 %) and disc height loss of the operated levels with foraminal narrowing were common. Pain level on a 10-point VAS improved from a preoperative mean value 8.8 to 4.3 (student t test, $p< 0.05$) at latest follow-up. Six patients reported postoperative pain greater than their preoperative level. Only seven patients of all the control group taking NSAI drug daily in preoperative period needed to take drugs in postoperative period.

In our series there's no recurrence or listhesis and only two subsidence in study group (4.76 %) in following period. The rate of disc height loss was greater in the control group, 96 % (48 of 40 patients). This rate was 61.9 % (26 of 42 patients) in study group. This was statistically significant, $p<0.05$.

Complications other than pseudoarthrosis (study group = 8/42) included three dural tear intraoperatively in study group (Table-3). There was no evidence of clinical arachnoiditis or cage-related complications in the study group. Only one discitis in control group (Table-3).

DISCUSSION:

From the first reports of spinal arthrodesis 98 years ago, a lot of techniques for lumbar spine have been developed for the management of a wide range of conditions [1,5]. The rate of bone grafts alone have ranged from 46 % to 90 % [4,8,15,17,20]. Because of difficulty in achieving fusion and maintaining spinal stabilisation, spinal instrumentation has become an important and popular adjunct to bone grafting in lumbar arthrodesis, further increasing the fusion rates, 80-90 % [19].

More recently, interbody fusion techniques have also shown high fusion rates with distinct advantages [11-14,16]. Some of the advantages include immediate anterior column load sharing, a large surface area for fusion, bone graft subjected to compressive loads that is advantegous in achieving fusion, and the ability to restore normal sagittal contour while indirectly decompressing the neuroforamen [11]. Interbody fusion technique also appear to be the most effective treatment of discogenic back pain that is unresponsive to conservative care [6,21].

Posterior interbody techniques allow surgeons simultaneously adressing all the pathological lesions though a single approach. Shorter incisions and care muscle stripping have resulted in less soft tissue dissection. When combined with pedicle screwing, anterior and posterior column stabilization can be achieved. The addition of interbody fusion to a posterolateral fusion provides 3600 circumferential fusion bed and may be associated with improved fusion rates.

Some biomechanical studies about bilateral posterior lumbar interbody fusion without additional posterior instrumentation have suggested that significant destabilization of the fused segment may occur [10,14]. In bilateral interbody fusion significant bilateral bony and ligamentous removal is often required to allow accurate placement of properly sized implants. However we used unilateral PEEK cages with anatomic shapes and made limited laminectomy in study group. So we could placed PEEK cage full of DBM putty graft into the intervertebral space to preserve the disc height, prevent the recurrence and additonal support to the facet joint. In our series there's no recurrence or listhesis and only two subsidence in the study group (4.76 %) in following period. The rate of disc height loss was greater in the control group, 96 % (48 of 50 patients). This rate was 61.9 % (26 of 42 patients) in the study group. This was statistically significant ($p<0.05$).

This may be partly because of an overall favorably patient population. Patients have no multiple comorbidities potentially affecting success of operation and fusion (heavy smoking, diabetes, previous failed fusion).

Unilateral posterior cage application can be easily mastered and there's no serious learning curve if a surgeon operate a lumbar disc patient so he/she can do it. After a meticulous disc removal as our patients, unilateral posterior approach is used to place the cage.

CONCLUSION:

UPLIF is indicated for chronic mechanical pain related to DDD, recurrent disc herniation. With this technique recurrence of disc and the possibility of foraminal narrowing and loss of

height can also be reduced. The most advantage of the PEEK cage is to preserve the disc space height and prevent the recurrence.

Unilateral posterior PEEK cage application and fusion is a safe and reproducible technique to provide unilateral posterior column support. The ideal patient for this procedure is one with long standing mechanical back pain with a significant radicular component unresponsive to aggresive nonoperative treatment with radiologic evidence of same side facet joint hypertrophy. We do not recommend this procedure more than two levels, ideal indication is one level. Proper patient selection continues to be the most important factor in good clinical outcome with this procedure as well as others.

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