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ORIGINAL ARTICLE

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The effect of epidural free fat graft on the outcome of lumbar disc surgery

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Abstract Numerous materials have been used to prevent epidural scar tissue after lumbar disc surgery. Free fat grafts are common both experimentally and clinically, but there is some doubt about their protection against fibrosis, and some complications have been reported. In this prospective study, the usefulness of free fat grafts during lumbar disc surgery was evaluated. Ninety-nine patients who had undergone operation due to lumbar disc herniation were divided in two groups: those with implantation of free fat grafts (group A) and those without (group B). Outcome was evaluated at a mean of 2.6 years postoperatively according to the following criteria: visual analog scale for back and leg pain, Hannover Questionnaire on activities of daily living, reflex findings, sensory and motor deficits, consumption of analgesics, walking distance, straight leg raising test, and clinical examination. The outcome variables showed no significant differences between the two groups ($P>0.05$). This study suggests that the use of free fat grafts during lumbar disc surgery was clinically ineffective.

Keywords Fat graft · Lumbar disc · Scar

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Introduction

Epidural scar formation is a natural consequence of lumbar disc surgery. Excessive postoperative epidural fibrosis is considered a major causative factor of failed back syndrome [2, 22, 30, 32]. It can cause fixation and traction of dura or nerve roots [2, 22, 32]. However, several authors have reported that there are no important differences between symptomatic and asymptomatic patients in fibrosis demonstrated by computed tomography (CT) and magnetic resonance imaging (MRI). They concluded that the degree of fibrosis was not related to recurrent symptoms following lumbar disc surgery [1, 19, 24, 25].

The control of scar formation has been one of the main concerns in disc surgery and the subject of research for many years. A large variety of materials have been implanted onto the dura in experimental and clinical studies to prevent or reduce scar formation [6, 8, 10, 18, 23, 28, 29, 31]. Free fat graft (FFG) is one of the methods most commonly used in daily practice [4, 12, 17, 33]. However, the reported results with this method are varied [3, 10, 11, 16]. There is some doubt about its protection against fibrosis [3, 11]. Furthermore, complications have been reported in connection with this method [5, 20, 27].

In this study, we performed double-blind, randomized evaluation of the use of free fat graft on patients operated on for the first time for lumbar disc herniation.

Materials and methods

Ninety-nine patients were included in the study. All had undergone operation due to lumbar disc herniation at the Department of Neurosurgery, University of Trakya in Turkey, from December 1994 to December 2001. The clinical diagnosis of disc herniation was made by MRI, CT scan, or both. Reasons for exclusion from the study were: (1) previous back surgery, (2) other neurological disease, and (3) central spinal canal stenosis. Of the patients examined, 48 had undergone implantation of FFG (group A) and 51 had not (group B). The age range was 25–65 years.

All of the operations were performed by five experienced surgeons. Discectomy via flavectomy was performed in all patients

at the relevant level. The degenerated disc fragments were removed and the disc spaces evacuated. The autogeneic fat grafts were obtained from subcutis, and their size varied according to the extent of the area to be grafted and placed in the laminectomy area.

Follow-up examinations were performed a mean of 2.6 years after the operation by an objective clinical examiner (TP) who did not know whether free fat grafts had been used or not. The following subsets were included: pain intensity measured on a visual analog scale (VAS) for low back and leg pain, activities of daily living according to the Hannover Functional Ability Questionnaire (FFbH-R), consumption of analgesics, walking distance, straight leg raising (SLR) test, and clinical examination. The VAS scores for low back and leg pain were calculated separately from 0 (no pain) to 10 (totally disabled). The FFbH-R includes 12 questions concerning activities of daily living, and a high score indicates a high level of activity. Consumption of analgesics was classified into three categories: (1) none, (2) intermittent, and (3) regular. Walking distance was graded as: (1) less than 200 m, (2) 200 m–1 km, or (3) more than 1 km. The SLR test was performed with patients in the supine position and no dorsiflexion of the ankle. Straight leg raising to 70° or more was considered a negative test result due to stretching of short hamstrings, and results were graded as follows: (1) <30°, (2) 30–70°, and (3) negative or >70°. Overall assessment at follow-up was graded as follows: very satisfactory, satisfactory, acceptable, unchanged, or aggravated.

Statistics

In statistical analysis of the results, the *t*- and Mann-Whitney U tests were used for comparing differences among the individual groups. *P* values of less than 0.05 were considered significant.

Results

Characteristics of the patients in each group were similar and are summarized in Table 1. There was no statistical difference between groups ($P>0.05$).

The mean values of pain in groups A and B were 3.05±1.42 and 2.85±1.64, respectively, based on VAS scores for back pain. The VAS scores for leg pain were 2.46±1.36 in group A and 2.21±1.70 in group B. The mean FFbH-R scores were 18.97±3.51 in group A and 19.21±2.88 in group B. The VAS scores for back and leg pain and FFbH-R scores did not show a significant difference between groups ($P>0.05$). The SLR test was positive or below 30° in five patients, between 30° and 70° in 14, and negative or >70° in 80. Fifty-seven patients did not use analgesics, 36 used them intermittently, and six used them regularly. Walking distance was noted as less than 200 m in five patients, between 200 m and 1 km in 19, and more than 1 km in 75. In the overall assessment of 101 patients, 42 were graded as very satisfactory, 35 satisfactory, 16 acceptable, five unchanged, and one aggravated. Significant differences were not noted for reflex findings, sensory and motor deficits, SLR test, walking distance, consumption of analgesics, or overall assessment between groups A and B ($P>0.05$). The outcome variables are depicted in Table 2.

Four patients were reoperated during follow-up. Two (4.16%) were from group A and two (3.92%) from group B ($P>0.05$). One patient in each group was reoperated for herniation at a new level, and the second patient in group B had an operation due to recurrence.

Table 1 Patient characteristics of each group

	With fat graft	Without fat graft	*P* value
Age in years (mean±SD)	47.21±13.11	44.3±10.64	0.44
Gender *n* (%)			0.62
Male	23 (23.2)	23 (23.2)	
Female	25 (25.2)	28 (28.4)	
Side *n* (%)			0.91
Right side	23 (23.2)	25 (25.2)	
Left side	25 (25.2)	26 (26.4)	
Level *n* (%)			0.82
L2-3	1 (1.0)	–	
L3-4	2 (2.0)	2 (2.0)	
L4-5	28 (28.3)	33 (33.3)	
L5-S1	17 (17.2)	16 (16.2)	
Herniation *n* (%)			0.60
Disc protrusion	25 (25.2)	22 (22.2)	
Disc sequestered	23 (23.2)	29 (29.4)	
Total *n* (%)	48 (48.5)	51 (51.5)	

Table 2 Outcome variables at follow-up

	With fat graft	Without fat graft	*P* value
VAS scores for back pain (mean±SD)	3.05±1.42	2.85±1.64	0.95
VAS scores for leg pain (mean±SD)	2.46±1.36	2.21±1.70	0.86
FFbH–R scores (mean±SD)	18.97±3.51	19.21±2.88	0.28
Reflex findings *n* (%)			0.44
Normal	43 (89.5)	43 (84.3)	
Hypo- or areflexia	5 (10.5)	8 (15.7)	
Sensory deficit *n* (%)			0.39
Hypoesthesia	15 (31.3)	12 (23.6)	
No hypoesthesia	33 (68.7)	39 (76.4)	
Motor deficit *n* (%)			0.68
Paresis	11 (23.0)	10 (19.7)	
No paresis	37 (77.0)	41 (80.3)	
SLR test *n* (%)			0.59
<30°	3 (6.2)	2 (3.9)	
30–70°	5 (10.4)	9 (17.6)	
Negative or >70°	40 (83.4)	40 (78.5)	
Use of analgesics *n* (%)			0.54
None	27 (56.2)	30 (58.8)	
Intermittent	17 (35.4)	19 (37.3)	
Regular	4 (8.4)	2 (3.9)	
Walking distance *n* (%)			0.51
<200 m	3 (6.2)	2 (3.9)	
200 m–1 km	7 (14.6)	12 (23.5)	
>1 km	38 (79.2)	37 (72.6)	
Overall assessment *n* (%)			0.85
Very satisfactory	20 (41.6)	22 (43.1)	
Satisfactory	18 (37.5)	17 (33.3)	
Acceptable	6 (12.5)	10 (19.7)	
Unchanged	3 (6.2)	2 (3.9)	
Aggravated	1 (2.2)	–	
Total *n* (%)	48 (100)	51 (100)	

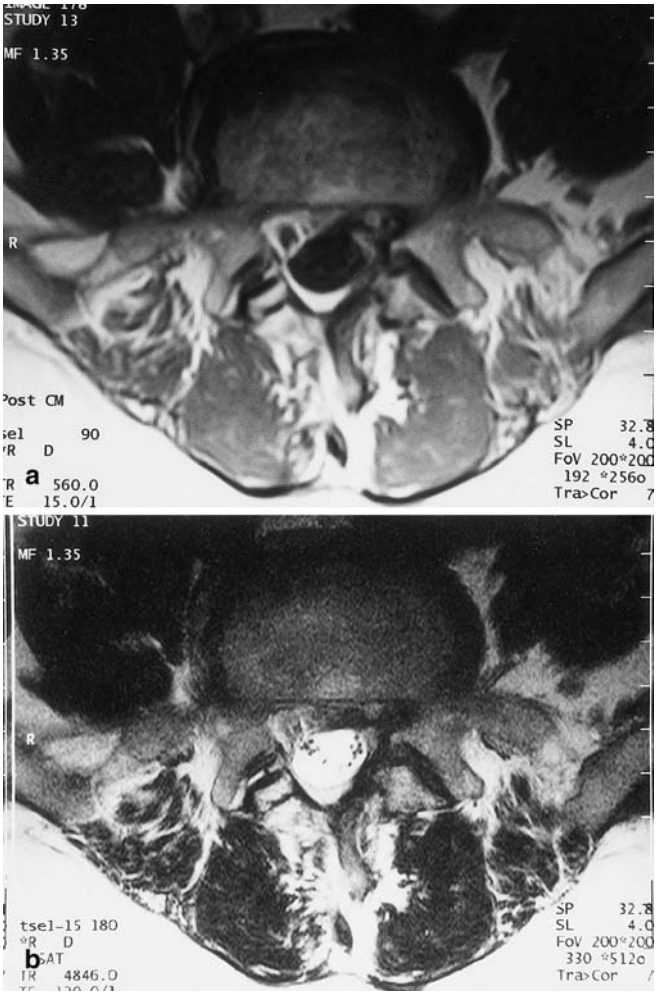

Fig. 1 MRIs in a patient. **a** T1-weighted image shows fat graft isointense with epidural fat intensity surrounding the L5 radix. **b** T2-weighted image at the same level in the same patient

The second patient from group A had been operated on for a right-sided L4-5 lumbar disc herniation in 1995. An L4-5 discectomy via partial hemilaminectomy was performed, and the right L5 root and dura were wrapped in a free autofat graft measuring 2×1×2 cm. The postoperative course was uneventful, and the patient recovered well. In 1999, he started getting the same sciatic pain he had suffered before surgery. An SLR test was positive at 45° on the right side. The patient had weakness in dorsiflexion of the feet and decreased sensation in the L5 dermatome. An MRI showed a doubtful lesion compressing and surrounding the left L5 radix at the level of L4-5 (Fig. 1a, b). In the second operation, this radix was compressed with a piece of a free autofat graft in the foramen which had been used during the first operation. It had dimensions of 2×0.5×1 cm. Histopathological evaluation showed vascularized, irregular fat tissue surrounded by fibromyelin tissue (Resim 2). Postoperatively, the patient was relieved of pain just after the operation, and neurological deficits gradually disappeared. For 3 years, follow-up examination was uneventful.

Discussion

The mechanism causing peridural scar formation is not fully clear. In 1948, Key and Ford were the first to report it after a lumbar disc operation [14]. They suggested that destruction of annulus fibrosis plays an important role in the genesis of scar tissue. Moreover, Nachemson suggested that a protein leak from the disrupted intervertebral disc might be a causative factor [21]. A reaction to foreign bodies from surgical debris as well as a systemic fibrinolytic defect have also been reported [7, 9, 15, 26]. However, many reports have pointed out that fibroblasts migrating from posterior tissues such as paraspinal muscles, ligamentum flavum, and posterior longitudinal ligaments may result in postoperative scar tissue after laminectomy [14, 18]. For this reason, many materials such as heparinized collagen, plastics, bone wax, laminar bone graft, synthetic membranes, etc. that could act as anatomic barriers between the dura and surrounding tissues have been placed at laminectomy sites experimentally [6, 8, 10, 18, 23, 28, 29, 31]. These materials have proven to be only moderately effective and were focused primarily on the volume of scar formed rather than on the functional effect of scar on surrounding neural tissues.

In a prospective, multicenter, double-blind, controlled study using Adcon-L antiadhesion barrier gel for preventing postoperative peridural fibrosis in patients undergoing first-time lumbar discectomy, treated patients had better clinical outcomes than those in the control group [28]. The autolog free fat graft is the most popular form of barrier. In various experimental and clinical studies using free fat graft after laminectomy, histological examination, postoperative CT scan, and MRI demonstrated the viability of fat graft with revascularization and reduction of scar tissue [12, 13, 17, 19, 33]. We have also used it for 10 years in surgery of lumbar disc herniation in our clinic.

Although peridural fibrosis is thought to be the cause of pain after lumbar disc surgery, the exact relation between the amount of scar tissue and symptoms remains controversial. In several studies using CT and MRI, no relationship between peridural fibrosis and symptoms has been shown [1, 19, 24, 25]. In the present study, we found no statistically significant difference between the two groups regarding VAS scores for radicular or low back pain, walking distance, use of analgesics, or SLR test. Our results were supported by several prospective clinical studies including fat graft and control groups with no interpositional membrane [3, 11, 19]. Bernsmann et al. found no significant difference between two groups, in either clinical outcome or social aspects [3]. Jensen et al. evaluated lumbar disc herniation with and without free fat transplantation with reference to clinical factors and enhanced CT scan 1 year after operation [11]. They concluded that free fat graft can reduce the extent of scar tissue after operation but does not result in a clinically better outcome.

The use of free fat grafts is also not without complications. Most seriously, dural compression by a

free autogenous fat graft with resulting cauda equina syndrome or symptomatic root compression has been reported [5, 20, 27]. These complications were observed in the early postoperative period. Hematoma formation anterior to the grafted fat and direct compression by a large fat graft pushed by the paraspinal erector muscles have been suggested as possible mechanisms. However, none of these mechanisms explains the cause of the present complication, which occurred in the late postoperative period. Because the fat graft had shrunk and vascularized, it is very hard to explain what caused the graft to become displaced into the foramen.

Conclusion

The use of free fat graft for the prevention of scar formation in lumbar disc surgery does not improve clinical outcome and or appear to be safer than other methods.

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