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Types of herniated discs and outcomes of lumbar microsurgical discectomy with extended foraminotomy among young Turkish army personnel

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Abstract

Objective: The present study is conducted to evaluate the findings of lumbar disc disease among the young adults who are under hard physical conditions in military service.

Materials and Methods: Data of 454 lumbar disc hernia patients who underwent microsurgical discectomy have been analyzed retrospectively. Patients' age, predisposing factors, duration of symptoms, levels of disc hernia, intraoperative findings, Visual Analog Scores (VAS), and Oswestry Low Back Pain Disability Questionnaire (ODI) data were reviewed from hospital records.

Results: All patients had severe radiculopathy. The 78% of the patients were smokers. Nevertheless, all recurrent disc patients (100%, n = 14) were heavy smokers. Majority of the patients (n = 424, 95%) had problem in just one vertebral point and the most common affected vertebral section was L4-L5 (n = 287, 59%). Disc herniation was centrolaterally placed in 94% (n = 425) patients. The mean VAS and ODI scores at final follow-up were 1.52 and 13.25 points with a reduction from a mean preoperative 7.08 and 60.45 points, (P < 0.001).

Conclusion: Posterior longitudinal ligaments were intact and mostly centrolateral and subligamentous disc herniation were shown in young adult army personals. The comparable effect of smoking on microvascular circulation at the operation site may be effective on recurrence.

Key words: Foraminotomy, lumbar disc herniation, microsurgery, young adults

Introduction

There are many potential causes for low back pain and disc hernia in adolescents. Low back pain may reasoned by muscular, ligamentous, infectious or congenital pathologies of the lumbar spinal column (1-3). Sedentary life conditions and minimal sportive activity may cause muscular and ligamentous weakness. Patients with back pain, radicular pain and subsequently with neurological deficit due to nerve root and/or dural sac compression are commonly referred to medical services.

Lumbar disc herniation is mainly problem for adults and elderly people as degenerative changes progress with age. Most patients over fifth decade present with degenerative changes in discs, vertebral end plates, and facet joints. Although lumbar disc hernia is the most common entity of the spinal diseases in the elderly population, this is rare in paediatric ages and young adults (4, 5).

Military personnel are young and motivated groups, whom physical conditions are superior to that of the general public. The presented study was conducted to evaluate the findings of lumbar disc disease among the young and active population who are under hard physical conditions in military service.

Materials and methods

Data of 454 lumbar disc hernia patients who underwent microsurgical discectomy and extended foraminotomy was analyzed retrospectively at the departments of Neurosurgery. Patients' age, predisposing factors (sport activity, smoke, familial predisposition, obesity), duration of symptoms, levels of operated disc hernia, operation findings, Visual Analog Scores (VAS), and Oswestry Low Back Pain Disability Questionnaire (ODI) data were reviewed using hospital records.

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Physical examination, X-ray graphs and magnetic resonance imaging (MRI) were applied to all patients. Patients with accompanying diseases such as spondylolisthesis, congenital malformation, infection and/or inflammation of the spine, and previous surgeries in the past were not included in the study.

Patients were classified into four groups according to the duration of symptoms before admission. Patients in the Group I (duration of symptoms: 0-3 months), Group II (duration of symptoms: 4-6 months), Group III (duration of symptoms: 7-9 months), and Group IV (duration of symptoms: 10-12 months) admitted our department during their military services. All of the patients received conservative treatment according to physical therapists' order prior to surgery. Each individual underwent C-Arm fluoroscopic level control and microsurgical discectomy with extended foraminotomy (6). Patients who were not doing well clinically enough to return to full duty were checked up with MRI or computed tomography scan and/or flexion-extension radiographs.

VAS and ODI scores were recorded from the database of the departments (Standard clinical follow-up protocol: 3rd, 6th, and 12th month follow-up during the first year of postoperative period).

Results

All patients were male, private soldier and their ages varied between 20 and 26 years. The patients had low back pain and severe radicular pain that were resistant to either medication or physiotherapy; 87.6% (n = 398) of the patients had severe disability.

Most of our patient population 80.2% (n = 364) had history of sedentary life conditions before joining to military service. The 19.8% (n = 90) of patients had habit as a regular sport activity (body building and running everyday, playing football and swimming weekly) in their civilian circle. However, all of the patients had severe radicular pain rather than low back pain after sports practice during their military service.

The 78% (n = 354) of patients were smokers and all recurrent disc herniated patients (n = 14) were heavy smokers. The 27.7% (n = 126) of patients had disc hernia history in their families. None of the patients was obese. The data of the patients is summarized in the Table 1.

Out of 484 operated levels, 59% (n = 287) of levels were L4-L5 and 37% (n = 180) of levels were L5-S1. Limited number of patients had L3–L4 level herniations 3% (n = 14) and L1-L2 level herniations 1% (n = 3). 80% (n = 364) of patients underwent surgery at the admission of first 6 months period (in Group I and II) (Table 2).

Herniated discs were not degenerative (they were observed as soft, hydrated, and rubbery intraoperatively) in 84% (n = 382) and were degenerative in 16% (n = 72) of patients. Disc herniations were contained and subligamentous in 85% (n = 386), and extruded in 15% (n = 68) of patients. It was centrolaterally placed in 94% (n = 425) and centrally placed in 6% (n = 29) of patients.

The patients without complications were satisfied with their outcome. Although the levels evaluated with fluoroscopic level control intraoperatively, two of them were operated for wrong levels but not developed additional neurological deficits postoperatively. There were 15 complications including 14 recurrent disc herniations and 1 discitis. The 14 patients suffered recurrent disc herniation in mean 8.5 (range, 4 – 16) weeks after initial surgery. By disc type, recurrence occurred from the 5.8% (n = 4) of extruded, 2.5% (n = 10) of contained disc herniations. By level, 3 recurrences were at L5–S1 level and 11 at L4–L5 level.

The 2.5% (n = 14) of patients underwent repeated discectomy, and 7% (n = 1) of recurrent disc hernia patients were treated with posterior transpedicular screw fixation due to instability. One of the patients who developed discitis, treated with antibiotic and hyperbaric oxygen therapy according to the protocol was suggested by Kutlay et al. 2.8% (n = 13) of patients with complications returned to full military duty within 6 months (7).

The mean VAS leg pain score at final follow-up was 1.52 points (range, 0 – 5), ($P < 0.001$), with a reduction from a mean preoperative 7.08 points (range, 0 – 10), ($P < 0.001$) (Paired Samples t-test) (Table 3). A decrease greater than 4 points on the VAS was observed in 368 (81%) of the patients. The mean ODI score demonstrated improvement from a mean score of 60.45 (range, 10 – 100), ($P < 0.001$), before surgery to 13.25 (range, 00 – 35), ($P < 0.001$) at final follow-up (Paired Samples t-test) (Table 3). 359 of all patients (79%) had a decrease in ODI score at least 20%. There was a positive significant correlation between patient satisfaction and outcome measures ($P < 0.001$) (Figure 1).

Table 1: Data of 454 young male patient Lumbar Disc Hernis (LDH) sections.

Levels of disc herniation	Uni L. L1-L2	Uni L. L3-L4	Uni L. L4-L5	Uni L. L5-S1	Bi L. L4-L5	Bi L. L5-S1	Ipsi L. L3-L4, L4-L5	Ipsi L. L4-L5, L5-S1	Bi L. L4-L5, L5-S1
Patients number (n = 454)	3	7	242	152	15	5	7	14	9
Mean age (year) (mean: 22.8 years)	23	24.8	22.3	22.77	21.7	23.6	22.5	22.15	22.8
Recurrence (n = 14)			10	2	1				1**
Familial predisposition(n: 126)		3	44	30	12	8	5	16	8
Smoker (n: 354)	1	5	189	119	9	5	5	14	7
Sedentary life (n: 364)*			195	135	12		1	12	9
Sports hobby (n: 90)	1	4	53	17	3	5	5	2	

* Number of the patients is given who had sedentary conditions in civilian circle.

** One patient who had recurrence LDH at the L5-S1 level

L.: Lateral

Table 2: Patient groups depending on the duration of symptoms

Group	I	II	III	IV
Duration of symptoms (months)	0-3	4-6	7-9	10-12
Number of patients	219	145	68	22

Table 3: Overall mean preoperative to postoperative outcome scores and p values of VAS and ODI (VAS: visual analog scores; ODI: Oswestry disability questionnaire index scores; preop: preoperative; postop: postoperative)

patients (n=454)	mean preop score (n=454)	mean postop score (3^{rd}month)	mean postop score (6^{th}month)	mean postop score (12^{th}month)	p value paired t-test
ODI	60,45±4,23 (10-100)	36,13±2,38 (0-90)	26,23 ±2,11 (0-70)	13,25±1,76 (0-35) **(n=359)**	< 0,001
VAS	7,08±1,55 (0-10)	3,87±0,86 (0-7)	2,84 ±0,64 (0-6)	1,52 ±0,32 (0-5) **(n=368)**	< 0,001

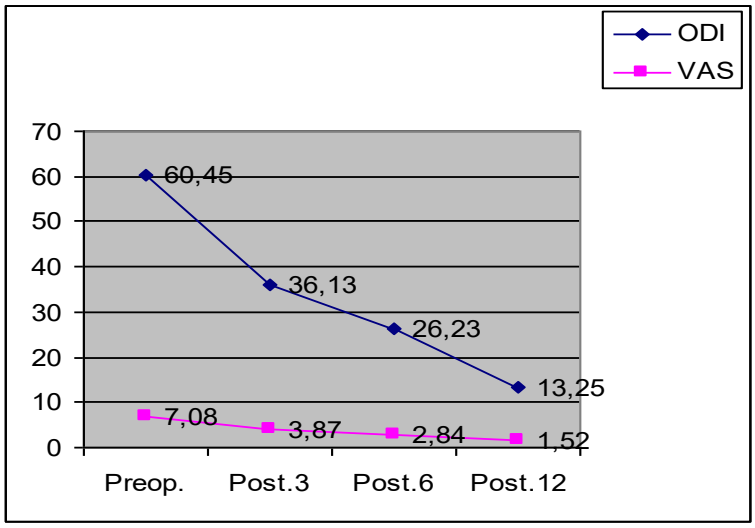

Figure 1: The correlation of VAS and ODI scores of the study group at the clinical follow-up periods. VAS: visual analog scale scores; ODI: Oswestry disability index scores; Preop: preoperative period; Postop.3: postoperative 3rd months; Postop.6: postoperative 6th months; Postop.12: postoperative 12th months.

Discussion

The aim of our current retrospective study was to analyze the symptoms, findings, and clinical outcome of lumbar discectomy in young military personals between ages of 20-26 years. Previous studies have suggested that patient age at the time of surgery is not predictive of outcomes (8). However, we are not aware of any previous large case series focusing on outcomes in a young male population in the military service. To our knowledge, the mean age of 23 years in our study is approximately 15 to 20 years younger than any other large series reported in the literature (9-13).

Varlotta et al. (14) calculated the relative risk of lumbar disc herniation before the age of 21 and found it to be approximately five times greater in patients who have a positive family history. Matsui et al. (15) suggested that there is a familial predisposition and a clustering of lumbar disc herniations among the relatives of 18- year-old or younger patients with lumbar disc herniation. Smorgick et al. (5) reported that there is a familial predisposition (46%) in young patients. In the current study, there is a family history (27.7%, n = 126) between the ages of 21-26. In our opinion, familial history may not be a predisposing factor in young and prospective studies are needed to further evaluations.

Although there is a correlation between smoking and failed back spine surgery, Dewing and Battie reported that there was not any correlation between smoking and less satisfactory outcomes (4, 16-18). In the current study, 78% of the patients were smokers (19). Nevertheless, all recurrent disc patients (100%, n = 14) were heavy smokers. There may be a correlation between recurrence and smoking because of the comparable effect of smoking on microvascular circulation at the operation site (16, 20, 21).

Bradford and Epstein considered trauma as the main etiological factor in the development of adolescent disc herniation that was most often related to lifting or twisting in adults. However, Smorgick et al. (5) suggested that there was not any relationship between trauma on lumbar spine and disc hernia but severe physical stress on the lumbosacral spine related to participation in competitive sports was probably predisposed to disc herniation. In the current study, there was no history of trauma. 19.8% patients had sports practice and 87.6% had sedentary life conditions in their civilian circle.

Moreover, the young patients in our series had a history of mechanical stress to the lumbar spine, specifically because

of intense sports activity that includes heavy lifting, long jumping, height jumping, carrying back packs that can weigh in excess of 80 lbs, and mandatory physical readiness testing in military practice.

The clinical presentation of adolescent disc herniation is varied. The symptoms are subjective and it is difficult to evaluate the adolescent age group. Pronounced back stiffness with or without sciatic scoliosis may evolve. Many adolescents may be undiagnosed for many months because their leg pain may be attributed to minor trauma, muscle sprain, or tight hamstrings. The predominant mechanical signs were low back pain, paravertebral muscle spasm, and severe radicular pain. Lordosis and degenerative changes at the L4-L5 level may be predisposing factors as in the literature. As noted, this range of signs is more specific presentation of lumbar disc herniation (22).

In addition to leg pain, gait abnormalities are also common, presenting signs of adolescent disc herniation. Previous studies (5) have suggested that low back pain associated with leg pain was the main clinical symptom in 77% patients, leg pain in 15%, and back pain without leg pain in 8%. In the current study group, radicular pain was the main complaint of all patients. Increased duration of preoperative symptoms has been independently associated with poor outcomes in previous studies.

Mostly, in the study group, duration of complaints was less than 12 months and postoperative course was uneventful. Conservative treatment (bed rest, appropriate physical therapy, medication, etc.) as the primary treatment modality are recommended for most young patients with lumbar disc disease (22, 23). They had medically intractable or long-term incapacitating persistent back pain, severe radicular pain, and neurological deficits. Conservative treatment was ineffective for our study group because of continuous intense sportive activity in the military service.

Detailed evaluation of the young patients with back pain is very important. Physical examination and plain radiography often do not identify disc herniation but any possible causes of disc disease could be identified (23, 24). However, if there is a history of trauma, computed tomography is also very helpful for diagnosing lumbar fractures or bone anomalies. Whereas computed tomography and plain radiography are valuable for identifying fractures and different bone pathologies, magnetic resonance imaging is still effective diagnosing lumbar disc herniation or lumbosacral nerve root anomalies (25-27). We used magnetic resonance imaging to establish the diagnosis in our series.

All of the patients underwent surgery due to disc herniation with severe radicular pain that were resistant to conservative treatment. The technique of lumbar disc surgery is still controversial. There are different techniques such as laser disc decompression, endoscopic discectomy, fragmentectomy alone, simple discectomy, with or without lumbar dynamic stabilization in several series (4-6, 11, 13). The preferred surgery was microsurgical discectomy with extended foraminotomy in our series (6). Patient satisfaction was good, and the complication rate was comparable (3.3%, n = 15) (4). Our findings reinforce the accepted surgical technique (lumbar microsurgical discectomy with extended foraminotomy) effective and predictable treatment for radicular pain recalcitrant to non-operative management (4).

Ito et. al (28) have suggested that non-contained disc herniations may be successfully treated non-operatively. Contained disc herniations were associated with significantly poorer outcomes than either sequestered or extruded disc types (4, 10). In the current study, contained centrolateral discs were associated with the best outcome scores, significantly better than those associated with extruded disc herniations. In addition to that, early surgery patients (Group I) had poorer outcomes. Majority of the re-operated patients had extruded disc herniation. However, two patients underwent repeated surgery due to wrong operated levels. We evaluated all re-operated levels. We hypothesized that insufficient disc surgery may be accused.

In the current study, we observed the disc as soft, hydrated, and rubbery. Posterior longitudinal ligaments (PLL) were intact and also disc hernia was located subligamentously in young patients. Scapinelli's (29) hypothesis is the meningovertebral ligaments are a barrier to side-to-side migration of extruded lumbar disc herniations. Martinez et al. (30) suggested different type of disc herniations. Annulus breakage, annulus plus PLL breakage are the types of disc herniation. We did not observe any PLL breakage in young recruits. So, in our opinion, there may be two different hypotheses: 1) PLL is flexible and has a strong stretch structure, 2) disc is contained, hydrated and not more degenerative or calcified so, bending forces are not more effective to extrude the intervertebral disc.

Disc herniation level and clinical outcomes were also assessed. Dewing et al. (4) reported that L5-S1 level was the most commonly affected level contrarily to our series. In 95.3% of the cases, only 1 level was affected; the most common level was L4–L5.

There was no significant difference between the outcomes of L4-L5 and L5-S1 levels. The neural foramina for the S1 nerve are larger and less affected by progressive disc degeneration and foraminal narrowing. At level L3-L4 and L4-L5, there will be a narrowing at the disc space after removing the disc. There will be an effective decompression for nerve roots and good postoperative outcome scores after extended foraminotomy (Figure 1). We postulate that the surgical technique as microsurgical discectomy with extended foraminotomy is still effective on different disc levels.

Military personnel are required to maintain weight standards and physical readiness. They must be ready for conflict zone and hard life conditions in the field. Although the clinical presentation of disc herniation is varied, Dewing et al. (4) reported that the patients in military service returned to full duty after microdiscectomy 6 weeks later. We observed the young recruits and stated that they returned to full duty after 6 weeks after microsurgical discectomy with extended foraminotomy. Two of the patients (one discitis patient and one patient who underwent posterior fixation surgery) could not return to full duty.

Conclusion

Smoking can be a predisposing factor in developing recurrent lumbar disc disease. Mostly, centrolateral and subligamentous disc herniation were shown in young recruits. Early surgery has a poorer outcome but, microsurgical discectomy with extended foraminotomy has a high success rate for non-degenerative disc herniation, to maintain good outcome scores and patient satisfactions for young active patients.

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Author's Contributions: AE; Planning the research, **AE, SG, AG, SP, CA:** Patient examination, surgery, collecting and analyzing data, **AE;** preparing article and revisions.

Ethical issues: All Authors declare, Originality and ethical approval of research. Responsibilities of research, responsibilities against local ethics commission are under the Authors responsibilities.

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