Araştırma Makalesi / Research Article
doi: 10.18678/dtfd.606028

Düzce Tıp Fakültesi Dergisi / Duzce Medical Journal
2019;21(3):177-180

The Effect of Time Elapsed from the Onset of Symptoms to Surgery on Prognosis in Patients with Foot Drop due to Lumbar Disc Hernia

Lomber Disk Hernisi Nedeniyle Düşük Ayak Gelişen Hastalarda Semptomların Başlangıcından Ameliyata Kadar Geçen Sürenin Prognoza Etkisi

Mehmet Onur YÜKSEL[1]
0000-0003-0922-4249
Serdar ÇEVİK[2]
0000-0002-2733-4233

[1]Namık Kemal University Medical Faculty Department of Neurosurgery, Tekirdağ, Turkey

[2]Memorial Şişli Hospital Department of Neurosurgery, İstanbul, Turkey

Sorumlu Yazar
Corresponding Author
Serdar ÇEVİK
dr.serdarcevik@gmail.com

Geliş Tarihi / Received : 18.08.2019
Kabul Tarihi / Accepted : 11.11.2019
Çevrimiçi Yayın Tarihi / Available Online : 15.11.2019

ABSTRACT

Aim: The aim of this study was to evaluate the effect of the duration from foot drop development to nerve decompression on the rate and degree of recovery in foot drop clinic.
Material and Methods: We retrospectively reviewed 30 consecutive patients who had undergone microdiscectomy for foot drop clinic (ankle dorsiflexion 0/5 paresis) between April 2014 and February 2019. Patients were divided into three groups according to the time from foot drop development to surgery, as <72 hours, 72 hours to 1 week, and >1 week. Kruskal-Wallis and Bonferroni corrected Mann Whitney U test were used to evaluate the rate and degree of recovery of ankle dorsiflexion muscle strength between groups.
Results: In this study, 30 patients (18 females and 12 males) who underwent surgery for foot drop were evaluated. Mean age at the time of surgery was 46.5±13.5 (range, 18-72) years. Postoperative ankle dorsiflexion strength was 4.2±1.6 (range, 0-5) in <72 hours group, 1.7±1.6 (range, 0-5) in 72 hours - 1 week group and 1.0±1.3 (range, 0-3) in >1 week group. Postoperative muscle strength improvement level of <72 hours group was significantly different both from 72 hours - 1 week group (p=0.003) and from >1 week group (p=0.002). There was no statistically significant difference between 72 hours - 1 week group and >1 week group (p=0.427).
Conclusion: In foot drop clinic, the duration from onset of symptoms to surgical decompression was a statistically significant predictor of postoperative recovery rates.
Keywords: Foot drop; lumbar disc hernia; surgery; prognosis.

ÖZ

Amaç: Bu çalışmanın amacı, düşük ayak gelişiminden sinir dekompresyonuna kadar geçen sürenin düşük ayak kliniğinde iyileşme oranı ve derecesi üzerine olan etkilerini değerlendirmektir.
Gereç ve Yöntemler: Nisan 2014 ve Şubat 2019 arasında düşük ayak kliniği (ayak bileği dorsifleksiyonu 0/5 parazik) nedeniyle mikrodiskektomi geçirmiş olan ardışık 30 hasta retrospektif olarak incelendi. Hastalar düşük ayak gelişiminden ameliyata kadar geçen süreye göre <72 saat, 72 saat ile 1 hafta ve >1 hafta olmak üzere 3 gruba ayrıldı. Gruplar arasında ameliyat sonrası ayak bileği dorsifleksiyon kas kuvvetlerinin iyileşme oranlarını ve derecesini değerlendirmek için Kruskal-Wallis ve Bonferroni düzeltmeli Mann Whitney U testi kullanıldı.
Bulgular: Bu çalışmada, düşük ayak nedeniyle ameliyat edilen 30 hasta (18 kadın ve 12 erkek) değerlendirilmiştir. Hastaların ameliyat sırasındaki ortalama yaşı 46,5±13,5 (aralık 18-72) idi. Ameliyat sonrası ayak bileği dorsifleksiyonu kas gücü <72 saat grubunda 4,2±1,6 (aralık, 0-5), 72 saat - 1 hafta grubunda 1,7±1,6 (aralık, 0-5) ve >1 hafta grubunda 1,0±1,3 (aralık, 0-3) idi. <72 saat grubunun ameliyat sonrası kas gücü iyileşme seviyesi hem 72 saat - 1 hafta grubundan (p=0,003) hem de >1 hafta grubundan (p=0,002) anlamlı şekilde farklılık göstermekteydi. 72 saat - 1 hafta grubu ve >1 hafta grubu arasında istatistiksel olarak anlamlı bir farklılık görülmedi (p=0,427).
Sonuç: Düşük ayak kliniğinde semptomların başlangıcından cerrahi dekompresyona kadar geçen sürenin, ameliyat sonrası iyileşme oranlarında istatistiksel olarak anlamlı bir prediktör olduğu görüldü.
Anahtar kelimeler: Düşük ayak; lomber disk hernisi; cerrahi; prognoz.

INTRODUCTION

Foot drop, defined as a significant weakness of ankle dorsiflexion (ADF), can develop due to many etiologic reasons including central nervous system diseases (tumor, paralysis, amyotrophic lateral sclerosis) (1,2), peripheral nerve pathologies (peroneal or sciatic nerve compression) (3-5) and systemic diseases (multiple sclerosis, hypothyroidism) (6,7). Nevertheless, lumbar disc hernia is regarded the most frequent etiology of lumbar disc herniation causing compression of the spinal roots (8-10). Weakness of ADF may lead to falling and injuries due to a remarkable deterioration in ambulation, which, in turn, gives rise to the decrease in a person's mobility and quality of life. The development of foot drop may have a sudden onset and be progressive. It is known that it tends to show an acute onset in patients with disc herniation (11,12), which is considered as a serious symptom of an underlying lumbar pathology, and in the majority of the cases reported in the literature, surgery has been performed as the treatment option (13). A vital prognosis criterion for recovery is the degree of dorsiflexion weakness (14). However, it is indicated in the event of full loss of strength that the most important prognostic factor is the time elapsed from the onset of symptoms to the decompression of the nerve.

This study aimed to evaluate the effects of the time elapsed from the development of foot drop to nerve decompression on the recovery rate and degree in foot drop clinic.

MATERIAL AND METHODS

A total of consecutive thirty patients, who had undergone microdiscectomy due to foot drop clinic (ADF 0/5 paresis) by the same surgical team in two different state hospitals between April 2014 and February 2019, were retrospectively reviewed. Clinical records, radiological imaging reports and surgical reports were reviewed. Data on patient demographics and clinical features, the time elapsed between the development of foot drop and surgery, duration of surgery, and muscle strength of ADF in the early post-operative period were reached. The evaluation of muscle strength of the ADF was carried out by the assessment of the tibialis anterior muscle in accordance with the muscle strength scale of Medical Research Council (Table1). Comorbidities, including diabetes mellitus (DM), smokers, coronary artery disease, chronic obstructive pulmonary disease (COPD) and hypertension were ascertained from the medical records.

All procedures carried out in studies including human participants were conducted in compliance with the ethical standards of institutional and/or national research committee, the Helsinki Declaration and its amendments or comparable ethical standards. Ethical approval for the study was obtained from the institutional review board of Namık Kemal University (01.08.2019, 2019/21). Informed and written consent was obtained from all patients.

The patients were divided into three groups as regards the time elapsed from the development of foot drop to surgery, as <72 hours, 72 hours to 1 week, and >1 week.

Statistical Analysis

Normality assumption for continuous data were examined by Shapiro-Wilk test. The differences between the groups were analyzed by Kruskal-Wallis test followed by Mann Whitney U test with Bonferroni correction, since variables not showing normal distribution. Descriptive statistics given as mean±standard deviation and median (minimum-maximum). Categorical data were analyzed with Fisher-Freeman-Halton test and summarized as frequency and percentage. All statistical analyses were performed using MedCalc v.12.7.7 (MedCalc Software, Ostend, Belgium), and $p<0.05$ was considered statistically significant.

RESULTS

Thirty patients (18 females, 12 males) operated on for foot drop (ADF muscle strength 0/5 paresis) were evaluated in this study. Mean age of the patients at the time of surgery was 46.5±13.5 (range, 18-72) years. Level 2 extruded or sequestrated disc hernia was present in twenty-five patients at lumbar 4-5, and at lumbar 4-5 and lumbar 5 in sacral 1 level. Table 2 shows the subgroup demographics of the patients.

Table 1. Manual muscle test of ankle dorsiflexion based on the examination of the tibialis anterior muscle according to the modified Medical Research Council Scale of muscle strength

0	No contraction of tibialis anterior
1	Flicker of ankle dorsiflexion, but no movement of the ankle joint
2	Patient can dorsiflex ankle with the effect of gravity eliminated
3	Patient can dorsiflex ankle against gravity but no added resistance
4	Patient can dorsiflex ankle against gravity and moderate resistance
5	Patient can dorsiflex ankle against gravity and full resistance

Table 2. Demographic characteristics of participants

	<72 hours		**72 hours - 1 week**		**>1 week**		**p**
	Mean±SD	**Median (Min-Max)**	**Mean±SD**	**Median (Min-Max)**	**Mean±SD**	**Median (Min-Max)**	
Age (years)	42.0±15.8	40.5 (18-72)	48.4±15.4	48.0 (27-67)	49.5±7.8	49.5 (36-59)	0.831
Weight (kg)	72.2±4.9	71.0 (67-84)	73.7±8.8	75.5 (65-89)	73.1±10.3	72.0 (57-89)	0.905
Height (cm)	168.5±6.5	167.5 (163-179)	170.5±7.1	170.5 (160-182)	173.0±7.4	174.5 (160-181)	0.463
BMI (kg/m^2)	25.4±1.2	25.9 (23.5-27.0)	25.3±2.1	25.2 (22.2-30.1)	24.4±2.6	24.5 (21.5-28.4)	0.451
	n (%)		**n (%)**		**n (%)**		
Gender							
Female / Male	5 (50.0) / 5 (50.0)		8 (66.7) / 4 (33.3)		5 (62.5) / 3 (37.5)		0.808

BMI: Body Mass Index, SD: Standard Deviation, Min: Minimum, Max: Maximum

Medical comorbidities were included DM (five patients), smokers (16 patients), coronary artery disease (one patient), COPD (one patient) and hypertension (six patients). There was no significant difference between the subgroups in terms of comorbidity.

ADF in the early period examinations (postoperative day 1) of the patients was detected as 5/5 in 7 patients, 4/5 in one patient, 3/5 in one patient, and 0/5 in one patient out of 10 in <72 hours group; as 5/5 in one patient, 3/5 in three patients, 2/5 in two patients, 1/5 in 2 patients, and 0/5 in four patients out of 12 in 72 hours - 1 week group; and as 3/5 in two patients, 1/5 in two patients, and 0/5 in four patients out of 8 in >1 week group (Table 3).

Postoperative muscle strength was as 4.2±1.6 (range, 0-5), 1.7±1.6 (range, 0-5) and 1.0±1.3 (range, 0-3) in <72 hours, 72 hours - 1 week, and >1 week groups, respectively. Preoperative and postoperative muscle strength changes were calculated for each group. The differences between the groups were examined by Kruskal-Wallis test, and a statistically significant difference was found between the three groups (p=0.002). According to the post hoc test results, postoperative recovery level of <72 hours group showed a statistically significant difference in comparison to 72 hours - 1 week group and >1 week group (p=0.003 and p=0.002, respectively). No statistically significant difference was seen between 72 hours - 1 week group and >1 week group (p=0.427) (Table 4).

While ADF muscle strength was above 3/5 in 50.0% of our patients, 90.0%, 33.0% and 25.0% of these patients comprised those in <72 hours group, 72 hours - 1 week group, and >1 week group, respectively (Table 3).

Table 3. Distribution of postoperative ADF muscle strength improvement into groups, n (%)

Paresis	< 72 hours	72 hours - 1week	>1 week
5/5 (normal)	7 (70.0)	1 (8.3)	0 (0.0)
4/5	1 (10.0)	0 (0.0)	0 (0.0)
3/5	1 (10.0)	3 (25.0)	2 (25.0)
2/5	0 (0.0)	2 (16.7)	0 (0.0)
1/5	0 (0.0)	2 (16.7)	2 (25.0)
0/5	1 (10.0)	4 (33.3)	4 (50.0)

All patients had preoperative ADF muscle strength of 0/5 paresis, all measures of power are based upon the modified Medical Research Council Scale of muscle strength (see Table 1), ADF: ankle dorsiflexion

Table 4. Comparison of the postoperative mean ADF muscle strength values

	Mean±SD	Median (Min-Max)	p
<72 hours	4.2±1.6	5.0 (0-5)	
72 hours - 1 week	1.7±1.6	1.5 (0-5)	**0.002**
>1 week	1.0±1.3	0.5 (0-3)	

All patients had preoperative ADF muscle strength of 0/5 paresis, ADF: ankle dorsiflexion

DISCUSSION

The effect of time of surgical intervention on foot drop prognosis remains to be an issue of controversy in the literature. Therefore, numerous studies have aimed at defining predictive factors and their effect on the recovery of foot drop clinic. Nonetheless, the term 'foot drop' is defined as the apparent weakness of the ankle in clinical practice; however, the degree of weakness of the ADF may show differences in the literature. Since this condition may affect, at a great length, the prevalence and prognosis of foot drop, the severity of muscle weakness should be defined objectively. It was our aim in this study to put forth the efficiency of surgical intervention in patients with full loss of ADF (ADF 0/5 paresis).

In this study in which 30 patients with 0/5 paresis ADF muscle strength were evaluated, full recovery was seen in 8 (26.7%) patients postoperatively and partial recovery (ADF ≥ 3/5 paresis) in 15 (50.0%) patients. It was observed that our results are low when compared to those of previous studies in the literature. In the meantime, it has been reported that each 1 degree reduction in ADF muscle strength in the preoperative period results in a 10.0% decrease (Hazard ratio = 1.10) in the recovery of foot drop postoperatively (15). In a study by Matsui et al. (16) in 1995, the authors reported recovery in 80% of the patients; however, no information was given regarding the degree of recovery of the patients. Girardi et al. (17), in 2002, reported full recovery in 71.0% of the ADF loss patients after surgery, in their study included patients with mild and intermediate paresis, whose ADF muscle strength was 2/5 ≤ 4/5 paresis. In a recent study with inclusion criteria similar to ours, Aono et al. (8) have evaluated 46 patients whose ADF muscle strength was ≤ 3/5 paresis. While favorable results were reached in 41.0% of the patients, no recovery was seen in 28.0% of the patients. In a study conducted in 2009, where the patients were grouped with regard to their preoperative muscle strength values, 68.0% recovery rate was found in patients whose preoperative ADF muscle strength was as 3/5 paresis and 4/5 paresis and 27.0% recovery rate was found in those whose preoperative ADF muscle strength was ≤ 2/5 paresis (18). These differences in recovery rates reflect the differences in the range of preoperative muscle strength weakness in patient populations. One of the most important reasons of the low rates found in our study is due to the fact that all patients evaluated had a 0/5 paresis ADF muscle strength preoperatively.

While 90.0% recovery rate was ensured in <72 hours group patients undergoing early period surgical intervention, 33.0% and 25.0% recovery rates were found in 72 hours - 1 week group, and >1 week group patients, respectively. The efficiency of early period surgical intervention on foot drop prognosis has been documented many times in the literature. Postacchini et al. (19) have reported that the recovery degree of motor weakness that develop due to lumbar disc herniation is inversely proportional to the time elapsed to surgery. In a retrospective study evaluating 26 patients in whom decompression was performed due to foot drop, Bhargava et al. (20) have statistically shown that time elapsed from the development of foot drop to surgery is an important predictor in terms of recovery (Odds ratio = 0.93). In a recent study investigating the efficiency of the change in the time period elapsed from the development of foot drop to decompression on foot drop recovery, each one unit increase in the time elapsed has a negative effect on recovery at a rate of 33.0% (15). These data indicate that in order to prevent permanent damage, decompression must be performed before the inflammatory process in the

nerve tissue under compression leads to scar formation. However, nerve damages with acute development cause edema in neural transmission and a faster deterioration on methyl-glucose transport (21). While full recovery at a rate of 70.0% was established in surgeries performed during the first 72 hours of the onset of foot drop, full recovery could not be achieved in patients operated after a week.

CONCLUSION

In this retrospective study, 30 patients who developed foot drop due to lumbar disc herniation underwent microdiscectomy. Preoperative palsy duration was statistically significant predictors of foot drop improvement.

REFERENCES

1. Baysefer A, Erdogan E, Sali A, Sirin S, Seber N. Foot drop following brain tumors: case reports. Minim Invasive Neurosurg. 1998;41(2):97-8.
2. Stewart JD. Foot drop: where, why and what to do? Pract Neurol. 2008;8(3):158-69.
3. Coleman SH, Beredjeklian PK, Weiland AJ. Intraneural ganglion cyst of the peroneal nerve accompanied by complete foot drop: a case report. Am J Sports Med. 2001;29(2):238-41.
4. Hassan FO, Shannak A. Primary pelvic hydatid cyst: an unusual cause of sciatica and foot drop. Spine (Phila Pa 1976). 2001;26(2):230-2.
5. Yuen EC, So YT. Sciatic neuropathy. Neurol Clin. 1999;17(3):617-31.
6. Bhansali A, Chandran V, Ramesh J, Kashyap A, Dash RJ. Acute myoedema: an unusual presenting manifestation of hypothyroid myopathy. Postgrad Med J. 2000;76(892):99-100.
7. Bhagia SM, Siegelman ES, Gilchrist RV, Slipman CW. Compression fracture: identify the diagnosis. Pain Physician. 2002;5(4):401-4.
8. Aono H, Iwasaki M, Ohwada T, Okuda S, Hosono N, Fuji T, et al. Surgical outcome of foot drop caused by degenerative lumbar diseases. Spine (Phila Pa 1976). 2007;32(8):E262-6.
9. Iizuka Y, Iizuka H, Tsutsumi S, Nakagawa Y, Nakajima T, Sorimachi Y, et al. Foot drop due to lumbar degenerative conditions: mechanism and prognostic factors in herniated nucleus pulposus and lumbar spinal stenosis. J Neurosurg Spine. 2009;10(3):260-4.
10. Jönsson B, Strömqvist B. Motor affliction of the L5 nerve root in lumbar nerve root compression syndromes. Spine (Phila Pa 1976). 1995;20(18):2012-5.
11. Guigui P, Benoist M, Delecourt C, Delhoume J, Deburge A. Motor deficit in lumbar spinal stenosis: a retrospective study of a series of 50 patients. J Spinal Disord. 1998;11(4):283-8.
12. Andersson H, Carlsson CA. Prognosis of operatively treated lumbar disc herniations causing foot extensor paralysis. Acta Chir Scand. 1966;132(5):501-6.
13. Wang Y, Nataraj A. Foot drop resulting from degenerative lumbar spinal diseases: clinical characteristics and prognosis. Clin Neurol Neurosurg. 2014;117:33-9.
14. Naylor A. Late results of laminectomy for lumbar disc prolapse: a review after ten to twenty-five years. J Bone Joint Surg Br. 1974;56(1):17-29.
15. Macki M, Syeda S, Kerezoudis P, Gokaslan ZL, Bydon A, Bydon M. Preoperative motor strength and time to surgery are the most important predictors of improvement in foot drop due to degenerative lumbar disease. J Neurol Sci. 2016;361:133-6.
16. Matsui H, Kitagawa H, Kawaguchi Y, Tsuji H. Physiologic changes of nerve root during posterior lumbar discectomy. Spine (Phila Pa 1976). 1995;20(6):654-9.
17. Girardi FP, Cammisa Jr FP, Huang RC, Parvataneni HK, Tsairis P. Improvement of preoperative foot drop after lumbar surgery. J Spine Disord Tech. 2002;15(6):490-4.
18. Ghahreman A, Ferch RD, Rao P, Chandran N, Shadbolt B. Recovery of ankle dorsiflexion weakness following lumbar decompressive surgery. J Clin Neurosci. 2009;16(8):1024-7.
19. Postacchini F, Giannicola G, Cinotti G. Recovery of motor deficits after microdiscectomy for lumbar disc herniation. J Bone Joint Surgery Br. 2002;84(7):1040-5.
20. Bhargava D, Sinha P, Odak S, Tyagi A, Towns G, Pal D. Surgical outcome for foot drop in lumbar degenerative disease. Global Spine J. 2012;2(3):125-8.
21. Olmarker K. Spinal nerve root compression. Nutrition and function of the porcine cauda equina compressed in vivo. Acta Orthop Scand Suppl. 1991;242:1-27.