Return-to-Play Outcomes After Microscopic Lumbar Diskectomy in Professional Athletes

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Return-to-Play Outcomes After Microscopic Lumbar Diskectomy in Professional Athletes

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Background: It has been shown a microscopic lumbar diskectomy (MLD) is effective in getting professional athletes back to their sport after a herniated nucleus pulposus (HNP). There is a need for more information on the time it takes professional athletes to return after surgery.

Purpose: To determine average time for return to play and success in returning to play for professional athletes undergoing MLD.

Study Design: Case series; Level of evidence, 4.

Methods: Between 1996 and 2010, the senior authors treated 171 professional athletes for lumbar HNP. A retrospective review was performed using patient charts, operative reports, team medical records, and internet search. Eighty-five patients were treated with MLD, and 86 patients were treated nonoperatively. This study focused on the return to play of the operatively treated patients. Primary outcome measures were return rate and average return time, considering only patients whose sport is in season at specific postoperative time points.

Results: Of surgically treated patients, 89.3% returned to sport. The average time it took operative patients to return to their sport (return time) was 5.8 months. Progressive return data for surgically treated patients showed the percentage of athletes who returned increased from 50% at 3 months to 72% at 6 months to 77% at 9 months and 84% at 12 months.

Conclusion: The chance a player returns to play after MLD is 50% at 3 months, 72% at 6 months, 77% at 9 months, and 84% at 12 months. The overall chance of returning to play at any point is 89%.

Keywords: herniated disk; diskectomy; MLD; sports; athletes; return

It has been shown that microscopic lumbar diskectomy is an effective treatment for a herniated nucleus pulposus (HNP).[2,10,11] For professional athletes, successful return to sport after lumbar diskectomy has been well documented and has become the expected norm.[1,5,14] Multiple studies have shown average return to sport rates from 80% to 90% after single-level lumbar diskectomy.[5,12,16] Furthermore, post-diskectomy performance has been shown to be equivalent to presurgery performance.[1,5,16] One remaining unknown is predicting how long it will take a professional athlete to return to sport after diskectomy.

One of the more difficult challenges a spine surgeon has is predicting the time required before an athlete returns to sport. This time prediction affects personal and livelihood decisions by the player, as well as personnel and financial decisions by the team. The purpose of our study was to determine average time for return to play and the percentage of patients who returned to play for professional athletes undergoing lumbar diskectomy.

We also report on the demographics of our patient population. These data include pretreatment clinical findings in operative versus nonoperative patients with lumbar disk herniation. The purpose of this subanalysis was to discover whether there are pretreatment clinical findings that determine whether a patient will be treated operatively or nonoperatively. We do not directly compare results of operative versus nonoperative treatment, because these 2 groups are heterogeneous. The pretreatment clinical and radiographic findings most likely differ between the 2 groups, which determine the choice of treatment. Our goal in reporting demographic information is to discover which variables differ between the 2 groups before treatment.

METHODS

Inclusion Criteria

An initial retrospective review of 608 consecutive athletic patient files from 1996 to 2010 yielded 171 professional athletes presenting with a lumbar herniated nucleus pulposus. Diagnosis of HNP was made on magnetic resonance imaging (MRI) for all patients. Of those 171, 85 required surgical intervention in the form of microscopic lumbar

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TABLE 1
Comparing Demographic Variables Between Treatment Cohorts[a]

Variable	Treatment Cohort (% of total)		P
	MLD	Nonoperative	
Patients, n	85	86	—
Age, y	28.1	27.9	.79
Time in pain, d	98.6	109.1	.72
B/L ratio favoring legs, n (% of total)[b]	35 (50)	12 (18)	**<.001**
Stenosis, n (% of total)	12 (14)	17 (20)	.42
Spondylolysis, n (% of total)	2 (2)	5 (6)	.44
Spondylolisthesis, n (% of total)	2 (2)	5 (6)	.44
Degenerative disk disease, n (% of total)	8 (9)	21 (24)	**.01**
Degenerative joint disease, n (% of total)	4 (5)	9 (10)	.25
Annular tear, n (% of total)	1 (1)	12 (14)	**.002**
Radiculopathy, n (% of total)	35 (41)	20 (23)	**.01**
Positive straight leg raise, n (% of total)	48 (56)	29 (34)	**.003**
Positive cram test, n (% of total)	30 (35)	15 (17)	**.01**
Positive crossed straight leg raise, n (% of total)	15 (18)	4 (5)	**.01**
Prior back surgery, n (% of total)	5 (6)	7 (8)	.77

[a]Significant *P* values are shown in boldface. MLD, microscopic lumbar diskectomy; B/L ratio, back pain to leg pain ratio.
[b]These data were available for only 70 MLD patients and 66 nonoperative patients.

diskectomy (MLD), whereas 86 were treated nonsurgically. Surgical recommendation was made based on history, degree and distribution of pain, response to nonoperative care, presence of leg weakness, and MRI findings. Patients typically chose to undergo surgery if they were unable to perform their sport, had leg weakness, and/or were not responding to nonoperative treatment. Microscopic lumbar diskectomy was performed with either a McCullough retractor and laminotomy or tubular retractor and foraminotomy. Nonsurgical treatment included rest, physical therapy, oral medications, and spinal injections. Physical therapy for nonoperative patients and postoperative patients consisted of the same protocol. Patients were treated 3 to 5 times a week with trunk stabilization exercises. Clearance for return to sport consists of completion of Level V of trunk stabilization exercises on the Watkins-Randall scale,[13] excellent aerobic conditioning, completion of sport-specific exercises, gradual return to sport, and continuance of the trunk stabilization program after returning to sport. Patients could not officially return to their sport until their sport was in season.

All patients were treated by 1 of the senior authors between 1996 and 2010. Patient sources consisted of local Los Angeles sports teams, for which 1 of the authors is the spinal consultant, and referrals from team physicians, athletic trainers, team management, physical therapists, and other players, both domestic and international. The study consisted of a retrospective review of the patient chart, operative report, and team medical records, when available. A player was deemed as having returned once he or she logged at least 1 minute in a professional, regular season game. This data point was determined by consulting the game records of Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA), and the National Hockey League (NHL) through each league's official website. The Elias Sports Bureau is the official statistician for all of these leagues.[4,6-9] This method has already been well established in previous studies.[1,5,12,16]

Demographic Data

Demographic variables recorded include age; sport; time in pain; back pain to leg pain ratio; presence of radiculopathy; positive straight leg raise, crossover straight leg raise, bowstring cram test, and presence of adjacent level annular tear; congenital or acquired stenosis; degenerative disk disease; spondylolysis; and spondylolisthesis (Table 1). Back to leg pain ratio is a subjective report from the patient whereby both percentages must sum to 100% (For example, 90% back to 10% leg indicates an overwhelming degree of back pain). A back to leg pain ratio that favors the legs is one for which the patient identifies that more than half of his or her pain stems from the legs. Radiculopathy was defined as presence of neurologic loss (sensory and/or motor) in a radicular pattern on clinical examination. Electromyography was occasionally performed to rule out peripheral nerve entrapment. The bowstring cram test is radicular pain reproduction with palpation of the sciatic nerve in the popliteal fossa. Annular tear was defined as a high-intensity lesion on the T2-weighted sagittal MRI at an adjacent level to the disk herniation. Spinal stenosis was defined as narrowing of the spinal segment on MRI potentially contributing to the patient's symptoms, as determined by the treating physician.

Demographics were determined from written report by the patient on the initial consultation patient form. Also recorded was the presence of any comorbid spine disease at the same level of disk herniation as noted by the treating physician. This and all other treatment information was determined from the patient chart, surgical report, and consultation with the treating physician. This demographic information was then used to compare the initial

TABLE 2
Return Data, by Professional Sport

Sport	Total Surgeries, n	Returned to Sport, n	Returned to Sport, %	Average Time, mo
Football	33	28	84.8	6.6
Hockey	13	12	92.3	5.8
Baseball	19	17	89.5	5.1
Basketball	7	7	100.0	6.3
Other	3	3	100.0	3.8
Total	75	67	89.3	5.8
P value			.48	.44

presentation of athletes treated surgically with those treated nonsurgically (Table 1). All 171 patients were included in this comparison.

Outcomes Data

Of the 85 professional athletes treated with MLD for lumbar disk herniation, 5 retired from their sport for nonmedical reasons, 4 retired before the surgery, and 1 retired as a result of an unrelated rotator cuff injury. These 10 players were not included in the return to play calculations (Figure 1). A retrospective review of the final 75 cases was carried out to determine the rate of return to work, as indicated by the length of time between surgery and return to competitive play in each patient's sport. Calculations included professional athletes from baseball, football, basketball, and hockey. It also included 2 professional sailing athletes and 1 professional mixed martial artist (Table 2). A player was categorized as having returned once listed on an active roster for at least 1 professional, regular season game after surgery.

Progressive Return Data

Progressive patient return to play data consisted of tracking what percentage of players undergoing MLD had returned to play their sport at consecutive 3-month postoperative intervals. Return was defined as having logged at least 1 minute of playing time in a regular season game. For each patient, this return date was determined by using the game records of MLB, the NFL, the NBA, and the NHL through each league's official website. Eight of the 75 patients treated with MLD were professional athletes playing either internationally or domestically in minor leagues. For these players, there was no reliable method to obtain the exact date they returned to play, and therefore, the data from these players were not included in the calculations (Figure 1).

For the remaining 67, an assessment of each player's eligibility to return was made. For each postoperative time interval (3, 6, 9, and 12 months), a patient was designated eligible to return to play only if their sport was in season.

For example, an NFL player undergoing surgery immediately after the regular season ended would have surgery in January. The next NFL regular season games are not played until 8 months later, in September. For the purposes of our progressive return calculations, this patient would not be deemed eligible until the 9-month time interval, since his sport would not be in season at 3 months or 6 months after surgery. We did not include return to practice or preseason because this information is often unavailable. Once a player was deemed eligible

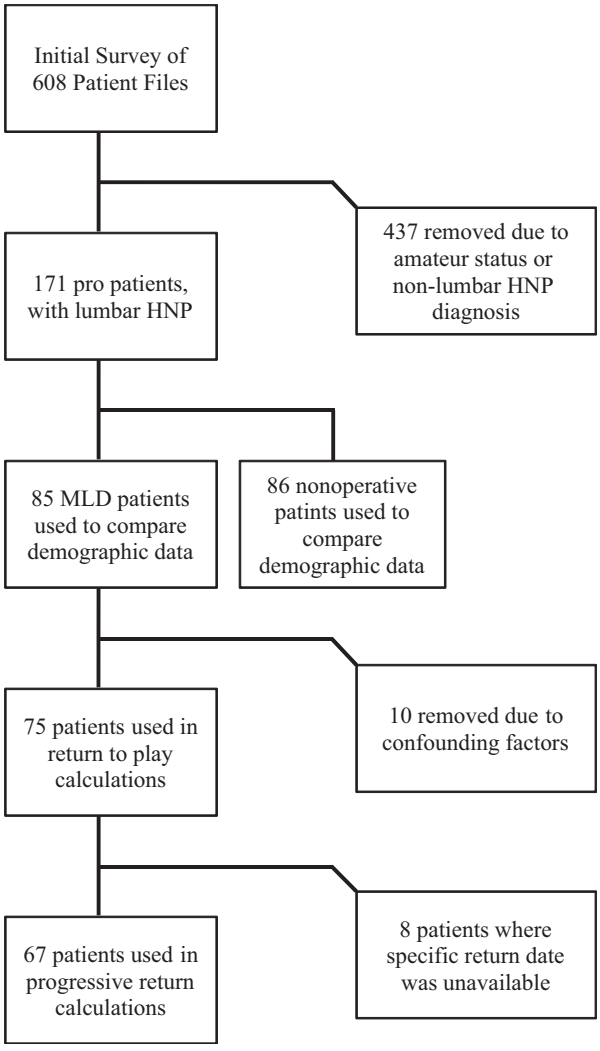


Figure 1. Flow chart tracking which patients met inclusion criteria for each stage of the study.

TABLE 3
Return Data, by Disk Operation Level

Neurologic Deficit	Total Surgeries, n	Return to Sport, n	Return to Sport, %	Average Time, mo
L3-L4	6	5	83.3	4.6
L4-L5	32	28	87.5	6.0
L5-S1	37	34	91.9	5.9
Total	75	67	89.3	5.8
P value			.62	.63

to return for a specific time interval, he or she was included for the duration of the calculations.

Statistical Analysis

Statistical analysis was conducted using STATA data analysis and statistical software, version 10.0 (StataCorp, College Station, Texas). Continuous variables between surgical and nonsurgical treatment cohorts were compared using a 2-sided Student *t* test for normally distributed data. An analysis of variance test was used to compare continuous variables between sports and disk levels. A Fisher exact test was used to analyze categorical variables. Statistical significance was accepted at $P < .05$.

RESULTS

Demographics

Of the 171 patients presenting with lumbar HNP, 85 were treated with MLD and 86 were treated nonsurgically. Comparison of the operative versus nonoperative patients showed there was no significant difference in average age (28.1 years MLD, 27.9 years nonoperative, $P = .79$), average time patients were in pain before their visit (98.6 days MLD, 109.1 days nonsurgical, $P = .72$), or the percentage of patients with prior back surgery (6% MLD, 8% nonoperative, $P = .77$) (Table 1).

There was a significant difference between the 2 groups in various measures of nerve function. Thirty-five of 85 (41%) MLD patients presented with radiculopathy, compared with 20 of 86 (23%) nonoperative patients ($P = .01$). Microscopic lumbar diskectomy patients were more likely to test positive on straight leg raise (56% MLD, 34% nonoperative, $P = .003$), crossed straight leg raise (18% MLD, 5% nonoperative, $P = .01$), and cram tests (35% MLD, 17% nonoperative, $P = .01$). Thirty-five of 70 (50%) MLD patients with back to leg pain ratio data available had a ratio favoring the legs, compared with 12 of 66 (18%) nonoperative patients ($P < .001$). Via these measures, MLD patients presented with significantly more radicular pathologic changes (Table 1).

Spinal pathologic abnormalities comorbid with lumbar HNP were also measured. Of the 85 patients treated with MLD, 14% had stenosis, 9% had degenerative disk disease, 5% had degenerative joint disease, 2% had spondylolysis, 2% had spondylolisthesis, and 1% had an annular tear. Of the 86 treated nonoperatively, 24% had degenerative disk disease, 20% had stenosis, 14% had an annular tear, 10% had degenerative joint disease, 6% had spondylolysis, and 6% had spondylolisthesis. Nonoperative patients were more likely to have degenerative disk disease ($P = .01$) and annular tear ($P = .002$) (Table 1).

Overall Return to Sport

The average rate of return to sport for professional athletes after lumbar diskectomy was 89.3%. The average time for return to sport was 5.8 months (range, 1-13 months) (Table 2).

Return Data by HNP Level

Return was also evaluated according to the disk level operated on during MLD. Of the disk levels operated on, the L5-S1 disk was the most common with 37 surgeries, whereas the L3-L4 disk had the least with 6 (Table 3). No operations were conducted on L1-L2 or L2-L3 disks. There was no statistically significant difference in percentage of athletes who returned to sport after surgery ($P = .62$) or average return time ($P = .63$) between different disk levels.

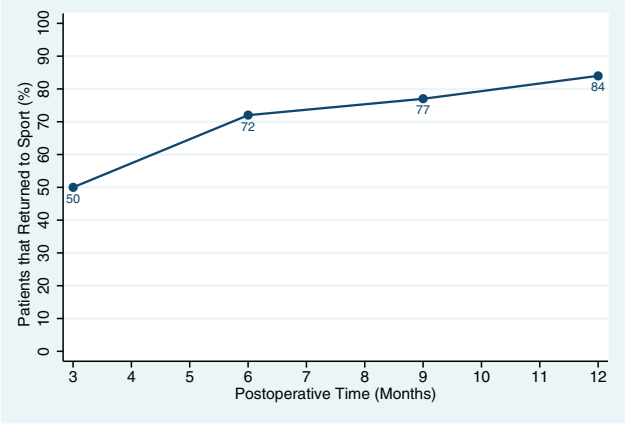
Return Data by Sport

The percentage of athletes that returned to sport after surgery was calculated for each sport. Of the 75 players eligible for return calculations (Figure 1), 67 (89.3%) returned to play. By sport, return to play rates ranged from 100% in basketball patients to 81.8% in football patients. There was no statistically significant difference in return to play rates between sports ($P = .48$).

Average time it took players to return to sport after surgery was also calculated for each sport (Table 2). The average return time for all patients was 5.8 months. Values ranged from 5.1 months for baseball players to 6.6 months for football players. There was no statistically significant difference in return time between any of the sports ($P = .44$).

Progressive Patient Return Data

Progressive patient return data were calculated to determine return rates for professional athletes. At each 3-month time point, players were deemed eligible for return



Months	Patients	
	Eligible to Return	Returned (% of Eligible)
3	28	14 (50%)
6	43	31 (72%)
9	57	44 (77%)
12	67	56 (84%)

Figure 2. Progressive return data. Return to play data adjusted to account for the fact that sports are not always in season, and therefore players not always eligible to return. Players were deemed eligible once their sport was in season at a data point. Return was defined as having logged at least 1 minute of playing time in a regular season game.

calculations only if their sport was in season. For example, for a patient who had surgery at the end of his season, he could not be eligible to return to his sport until the first game of the next season. These calculations take each athlete's professional season length into consideration, which results in a more realistic return rate than just the total length of time it took an athlete to return to sport following surgery. Calculations include patients from all sports. The number of patients who successfully returned to sport steadily increased from 50% at 3 months to 72% at 6 months to 77% at 9 months to 84% at 12 months (Figure 2).

DISCUSSION

Predicting time for return to play is a challenging aspect of treating professional athletes. Watkins et al[14] previously showed an average return of 5.3 months. However, confounding variables have probably distorted these data. Many athletes undergo surgery at the end of the season; therefore, the first possible date for return to play is not until the first game of the next season. In the NFL, the 8-month offseason automatically makes the return to play a minimum of 8 months. Thus, the time for return to play may be artificially increased because the player may have been physically able to return earlier if only the sport had been in season.

The progressive return to sport data from our study take into account whether an athlete's sport was in season. The player was considered eligible to return to sport at each time point only if their sport was in season. This graduated system should provide a more accurate analysis of time to return to sport.

Because of the duration of the offseason, most of the players were not able to return to their sport 3 months postoperatively. At the 3-month postoperative mark, the sports of only 43% of players were in season. Of those, 50% returned to play. Of the players whose sports were in season by the 6-month operative mark, 72% returned to sport. These data can be used to counsel a player and team that the percentage of players returning at 3 months was 50%, at 6 months was 72%, at 9 months was 77%, and at 12 months was 84%.

These progressive return to sport data can be compared with other post diskectomy results in patients who are not professional athletes. Donceel and Du Bois[3] showed a progressive return to work after lumbar diskectomy of 50% at 4 months, 65% at 6 months, and 78% at 1 year. Similarly, Weinstein et al[15] showed return to work rates of 64% at 3 months and 76% at 1 year.

The overall return to sport for our study was 89%. This finding is higher than the percentages reported in other studies on professional athletes. Hsu et al[5] showed 81% return in 226 professional athletes. For NFL players, Weistroffer and Hsu[16] reported 81% return to play for linemen, and Savage and Hsu[12] showed 74% for offensive skill positions. Anakwenze et al[1] found only 75% return to professional basketball. Our original study showed a return to sport of 88% for professional and Olympic athletes.

One of the reasons that our study reported a higher success rate in return to sport is because of the difference in methodology. Our study had more in-depth knowledge of the individual patients. Ten patients were excluded because they did not return to sport for reasons other than their spinal injury: 5 retired from their sport for nonmedical reasons, 4 retired before surgery, and 1 retired because of an unrelated rotator cuff injury. Studies that rely on internet searches or other databases may not account for confounding factors that adversely affect return to sport averages.

Additionally, our study provides demographic comparison on patients treated operatively versus nonoperatively. Patients treated operatively had significantly more radicular pathologic abnormalities. Patients treated nonoperatively had a significantly increased incidence of underlying degenerative disk disease.

Other studies have directly compared operative versus nonoperative outcomes.[1,5,16] There are 2 reasons we did not compare these 2 treatment groups. The first is that many patients were seen as referrals. Most nonoperative patients were treated by their respective teams across the country, whereas all the operative patients were treated by and followed up on by 1 of the authors of this study. As such, in many cases, the follow-up data for nonoperative patients are incomplete and the care was uncontrolled. The second reason is that we have shown that these 2 groups do not have similar pretreatment conditions. The difference in the 2 groups' pathologic lesions probably determines which treatment they received. Comparing the 2 groups by their outcome to treatment is inaccurate because they are 2 different types of patients. For example, patients who underwent surgery had more preoperative radicular lesions, which may distort comparing their outcome to nonoperative patients with fewer radicular lesions.

Limitations in our study include that retrospective analysis limits power of conclusions, prospective randomization of treatment may illustrate effectiveness of operative versus nonoperative treatment, and 8 patients were determined to successfully return to sport, but the date of return could not be determined. We also did not calculate information on the durability of the return to play; we know only that each player returned to play at least 1 minute, but not how long.

CONCLUSION

The average rate of return to sport for professional athletes after lumbar diskectomy was 89%. The average time for return to sport was 5.8 months. Based on whether a player's sport was in season, the percentage of return at 3 months was 50%, at 6 months was 72%, at 9 months was 77%, and at 1 year was 84%.

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