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ARAŞTIRMA YAZISI / RESEARCH ARTICLE

PERKÜTAN LAZER DİSK DEKOMPRESYONUNUN KISA VE UZUN DÖNEM SONUÇLARI: RETROSPEKTIF BİR COHORT ÇALIŞMA

SHORT AND LONG-TERM RESULTS OF PERCUTANEOUS LASER DISC DECOMPRESSION: A RETROSPECTIVE COHORT STUDY

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ÖZET

AMAÇ: Disk içindeki basıncın azaltılmasının, fıtıklaşmış disklerde sinir kökü basıncından kaynaklanan siyataljiyi ve bazı durumlarda diskojenik bel ağrısını iyileştirdiği rapor edilmiştir. Perkütan lazer disk dekompresyonu, disk hacmini (nükleus pulposus) azaltmak için kullanılan perkütan yöntemler arasında yer almaktadır. Yazarlar, lomber disk hernisi olan semptomatik hastalarda perkütan lazer disk dekompresyonunun etkilerini sunmayı amaçladılar.

GEREÇ VE YÖNTEM: L4-L5 disk herniasyonuna bağlı bel ve/veya bacak ağrısı şikayeti olan hastaların perkütan lazer disk dekompresyonu öncesinde Vizuel Analog Skala (VAS) ve Oswestry Engellilik İndeksi (ODI) kullanılarak klinik değerlendirmeleri yapıldı. Ameliyat sonrası 2. saatte erken VAS değerleri kaydedildi. Ayrıca operasyondan 1 ve 3 ay sonra ODI ve VAS kullanılarak klinik değerlendirme yapıldı. VAS değerleri ameliyat öncesine göre 10 üzerinden 2 puan veya daha fazla azalan hastaların işlemden fayda gördüğü kabul edildi. Uzun dönem sonuçlar için de en az 10 yıllık takipte ODI ve hasta tatmininin değerlendirilmesi için üçlü likert ölçeği kullanıldı.

BULGULAR: Kliniğimizde 21 L4-L5 perkütan lazer disk dekompresyonu uygulandı. Perkütan lazer disk dekompresyonunun başarı oranı, VAS değerlerindeki düşüşe göre ilk üç ay için %90,0 ve Oswestry Engellilik İndeksine göre on yıllık dönem için %72,73 olarak hesaplanmıştır.

SONUÇ: Başarı oranları, bu prosedürle hastalarda kısa ve uzun dönemde iyi sonuçlara ulaşıldığını göstermektedir. Bu tekniğin avantajları arasında kullanım kolaylığı ve ayaktan tedavi olarak uygulanabilmesi sayılabilir.

ANAHTAR KELİMELER: Fıtıklaşmış disk, Lumbar vertebra, Omurga, Perkütan, Lazer cerrahisi.

ABSTRACT

OBJECTIVE: Decreasing intradiscal pressure has been reported to improve sciatica, caused by nerve root pressure in herniated discs and improve discogenic low back pain in some cases. Percutaneous laser disc decompression is among percutaneous methods to decrease the disc volume (nucleus pulposus). The authors aimed to present the effects of the percutaneous laser disc decompression on symptomatic patients with lumbar disc hernia.

MATERIAL AND METHODS: The clinical assessments of the patients s with complaints of low back and/or leg pain due to L4-L5 disc herniation were performed using the Visual Analog Scale (VAS) and the Oswestry Disability Index (ODI) before percutaneous laser disc decompression. Early VAS values were recorded in the 2nd hour after surgery. Also, a clinical evaluation was performed using the ODI and VAS both 1 and 3 months after the procedure. The patients whose VAS values decreased by 2 points or more (out of 10) compared to the preoperative period were determined to have benefited from the procedure for these periods. For the long-term outcomes, ODI was used for at least 10 years of follow-up, and the triple Likert scale was used to evaluate patient satisfaction.

RESULTS: Twenty-one L4-L5 percutaneous laser disc decompressions were performed in our clinic. The success rate of percutaneous laser disc decompression was determined to be 90.0% for the first three months based on the decrease in VAS values and 72.73% over a ten year period, according to the ODI.

CONCLUSIONS: The success rates show that this procedure has achieved promising results for patients in both the short and long term. The advantages of this technique include the ease of use and its applicability as an outpatient procedure.

KEYWORDS: Herniated disc, Lumbar vertebrae, Spine, Percutaneous, Laser surgery.

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INTRODUCTION

Minimally invasive techniques percutaneously applied to intervertebral discs are based on the principle that any minor change in volume leads to a significant change in pressure (1, 2). Decreasing intradiscal pressure has been reported to improve sciatica, caused by lumbar nerve root compression in herniated discs and improves discogenic low back pain in some cases (3, 4). Moreover, decreasing intradiscal pressure may also potentially alleviate "tenting" low back pain, which has been reported to result from distention of the annulus and posterior longitudinal ligaments in herniated discs (4, 5). Percutaneous methods used to reduce disc volume (nucleus pulposus) include chemonucleolysis, automated percutaneous lumbar discectomy (APLD), nucleoplasty, and percutaneous laser disc decompression (PLDD).

The first PLDD procedure, used by Choy, involved the application of an intradiscal Nd: YAG laser that vaporized the nucleus pulposus (6). The disadvantages of this technique include the high cost of hardware, severe intraoperative pain, postoperative low back pain, muscle spasm and the possibility of heat damage to structures, such as the vertebral end plates and the spinal nerves adjacent to the disc. Over time, more technological developments, such as CO_2 and diode lasers, have been implemented. The PLDD procedure has become easier and safer with the common use of computed tomography. This advance could result in an increase in success rates and a decrease in complication rates compared with the previous series. The authors aimed to present the effects of the PLDD on symptomatic patients with lumbar disc hernia.

MATERIALS AND METHODS

Study Design

Patients suffering from low back and/or leg pain due to L4-L5 disc herniation and who underwent the PLDD in two years period between March 2007 and February 2009 were retrospectively enrolled in this report.

The patients' findings before percutaneous laser disc decompression, in the early post-procedure period, and the one and 3-month post-procedure periods were accessed from the hospital data recording system. After the approval of the Ethics Committee, patients were contacted by telephone and their conditions were questioned.

Informed consent has been obtained from the patients.

The inclusion criteria of the patients are presented as follows:

1- Contained L4-L5 disc herniation
2- Low back and/or leg pain presumably caused by this disc herniation
3- The low back and/or leg pain must have been present for at least 6 weeks, although medical/physical treatment may have been attempted
4- At least 70% of the normal disc height must have been retained (In further degenerated cases in which the disc height has decreased, intradiscal pressure has been reported to have already decreased, and reducing disc volume would not be expected to provide any benefit (7, 8). The mean of the heights of the L3-L4 and L5-S1 discs in the mid-sagittal sequence of the lumbar MRI was used to determine the normal L4-L5 disc height.

The exclusion criteria for PLDD were as follows:

1- Conditions requiring urgent treatment, such as cauda-conus syndrome, acute foot drop, and pain that does not respond to narcotic analgesics
2- Free disc fragment
3- Bone, facet and ligament compression, as these may be causing the symptoms rather than the disc herniation.

Evaluation Before Operation: Independent Variable

In addition to age, gender and pain localization, two clinical assessment parameters were used as independent variables. 1-Oswestry Disability Index (ODI) (9) 2-Visual Analog Scale (VAS). The VAS values were recorded separately for the patients' low back and leg pain scores. However, the VAS value of the area where the patient had the more significant pain was used in the statistical tests.

Evaluation After Operation: Dependent Variables

Three different outcome measures were used in different follow-up periods as dependent vari-

ables. 1-VAS: Individual patients whose VAS values decreased by 2 points or more (out of 10) compared with the preoperative period were determined to have benefited from the operation. 2-ODI: A statistically significant difference compared to preoperative values was accepted as a success criterion. Individual patients whose ODI improvement was net 19 points or more, a 37% improvement, or a final raw score of <31 points were determined to have benefited from the operation (10). 3-Satisfaction levels were measured using a triple Likert scale with the following questions. 1- Are you satisfied with the procedure? 2- Would you consider undergoing this procedure again if faced with the same situation? 3- Would you advise your relatives to undergo this procedure in a similar situation? Based on the responses, patients receive 3 points if the answer to all three questions is yes, 1 point if the answer to all three questions is no, and 2 points if there are mixed answers.

Percutaneous Laser Disc Decompression (PLDD)

The PLDD was performed on the patient using computed tomography. While the patient lay in a prone position on the Computed Tomography (CT) table, the level determination, puncture point, and needle trajectory were assessed using both lateral CT scout scans and axial scans (approximately 7 cm lateral to the interspinous midline, following a trajectory parallel to the inferior end plate). The puncture point was marked using a surgical pen. Povidone iodine was applied to the patient's back, which was then covered by sterile sheets. The sterile 18-gauge, 15-centimeters-long the Chiba needle and fiber optic PLDD probe were then unpacked, and the stylet of the Chiba needle was removed. The fiber optic probe was passed through the outer cannula of the Chiba needle and adjusted so that approximately 5 mm protruded from the tip of the outer cannula and secured using a stopper. The fiber optic probe was then removed from the outer cannula of the Chiba needle, and the drift stylet was affixed to the outer cannula again. The Chiba needle was then inserted at the previously marked point. The control axial CT scan was obtained after pushing the needle and feeling it pass through the annulus ***(Figure 1)***.

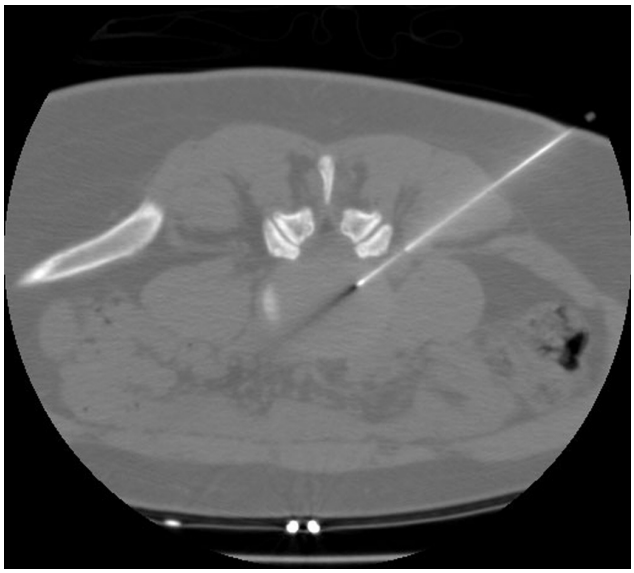

Figure 1: This figure shows the axial CT scan of our third patient during the operation.

After the annulus fibrosus was confirmed to have been passed (as the tip of the needle entered 5-10 mm beyond the disc-outer contour), the stylet of the Chiba needle, was removed, and the fiber optic PLDD probe, whose length had been set before the procedure was inserted into the disc through the Chiba needle. The other side of the fiber optic probe was connected to the diode laser device (Intermedic PL3D 980 nm diode laser). Three hundred joules of laser energy were applied to the L4-5 nucleus pulposus with 6 joules applied for a 500-millisecond duration every 2 seconds. Close verbal and visual contact with the patient was maintained throughout the procedure. If the patient complained about pain, the laser energy was stopped until the pain subsided. After 300 joules of energy were applied, the operation was terminated by removing the probe and the needle. The patient was then placed supine on the CT table, and muscle strength in both lower extremities was assessed. The patients generally described significant pain relief within minutes following the operation. The patients were monitored for about two hours by measuring their arterial blood pressures and pulses. The patients were re-examined two hours after the procedure, and their VAS values

were recorded. The patients were then given prescriptions for analgesics and myorelaxants and discharged from the hospital. The primary and the only outcome measure was the VAS for the early postoperative period.

Follow-Up

A clinical evaluation was performed using the VAS (primary outcome measure) and the ODI (secondary outcome measure) at 1 and 3 months postoperatively. For long-term assessment, conducted at least 10 years post-procedure, patient pain status was evaluated using the ODI (primary outcome measure) and triple Likert scale (secondary outcome measure) via phone interviews with the patients.

Ethical Committee

The approval for the study was obtained from The Ethics Committee of Izmir Katip Celebi University, under decision number 21.03.2024/0119.

Statistical Analysis

IBM SPSS Version 27 program was used for statistical tests. Chi-square and Fisher's Exact Tests were used for nominal variables. Independent samples t-tests were used to compare groups for both VAS and ODI values. Paired sample t-test was used to investigate whether there was a statistically significant change in the groups' VAS and ODI values compared to preoperative values. The success criterion for each period was considered the primary outcome measure. The Pearson correlation test was also utilized to compare two ordinal and/or scale variables. If $P<0.05$, it was considered significant in all tests.

RESULTS

Between March 2007 and February 2009, 21 L4-L5 PLDD were performed in our clinic. There were 11 female (52%) and ten male (48%) patients, and the patients were between 18 and 68 years of age (mean 38.71±14.08).

The complaint of the patients was pain and none of the patients had motor deficits. Low back pain was more prominent in most patients while only five patients (23.81%) experienced greater leg pain than low back pain **(Table 1)**.

Table 1: Summarized data

No	Age	Sex	Pain location	Side	PreT LBP VAS	PreT Leg Pain VAS	PreT OSW	PostT LBP VAS	PostT Leg Pain VAS	1st M LBP VAS	1st M Leg Pain VAS	1st M OSW	3rd M LBP VAS	3rd M Leg Pain VAS	3rd M OSW	10th Y OSW	Sat.
1	28	F	Leg	R	8	9	42	4	3	LFU	LFU	LFU	LFU	LFU	LFU	LFU	LFU
2	30	M	LBP	R	9	6	44	6	4	6	4	34	7	4	34	LFU	LFU
3	19	F	LBP	R	8	2	36	6	1	2	0	22	2	0	20	0	3
4	53	F	Leg	L	6	8	44	4	6	3	5	38	4	3	32	10	2
5	57	F	LBP	R	8	6	42	6	6	7	4	38	6	4	34	LFU	LFU
6	29	M	LBP	R	8	5	34	4	2	5	2	28	4	2	22	LFU	LFU
7	53	F	Leg	R	7	8	38	4	6	2	3	28	0	2	32	22	3
8	52	M	LBP	R	6	5	38	6	4	4	2	28	2	0	20	LFU	LFU
9	47	F	Leg	R	6	8	42	6	8	6	7	38	6	8	34	Op*	Op*
10	53	M	LBP	R	6	2	34	3	2	2	0	24	2	0	22	Op†	Op†
11	45	F	Leg	R	5	7	34	4	5	2	4	28	4	6	32	Op†	Op†
12	43	F	LBP	R	8	4	36	3	0	2	0	22	2	0	22	10	2
13	25	M	LBP	L	6	4	32	2	2	4	2	24	3	2	22	0	3
14	39	M	LBP	R	8	6	36	2	0	2	0	24	2	0	22	0	3
15	23	F	LBP	L	8	6	32	4	2	2	0	22	1	0	20	0	3
16	68	M	LBP	R	7	5	34	4	2	4	2	32	4	2	28	Ex.	Ex
17	35	M	LBP	L	8	8	38	2	5	2	2	32	2	0	28	LFU	LFU
18	18	F	LBP	L	8	7	34	2	0	2	0	24	2	0	20	0	3
19	30	M	LBP	R	6	3	36	4	2	4	3	34	4	2	32	LFU	LFU
20	24	F	LBP	R	8	4	32	5	2	6	2	32	0	0	20	LFU	LFU
21	42	M	LBP	L	7	4	40	4	2	2	4	36	0	2	28	LFU	LFU

M: Male, F: Female, LBP: Low Back Pain, Leg: Leg Pain, PreT: Pretreatment, PostT: Posttreatment, VAS: Visual analog scale value, R: right, L: left, M: Month, OSW: Oswestry Low Back Pain Disability Questionnaire Score, Sat: Satisfaction, LFU: Lost to Follow-Up, Op*: Dorsal root ganglion radiofrequency and knee surgery, Op†: Open lumbar discectomy after laser discectomy, Ex.: Exitus

Preoperative Period

General findings

The mean preoperative VAS value for the main complaint in the patients was 7.50±0.89. All patients had an ODI score above 31, and the mean preoperative ODI value in the patients was 37.05±3.93.

Comparative findings

Pain Localization: There was no significant difference in VAS values between the low back and the leg pain groups (7.44±0.96 and 8.00±0.71 respectively, Independent Samples T-Test, p=0.123). However, there was a significant difference between the low back and the leg pain groups in terms of ODI values (36.12±3.54 and 40.00±4.00 respectively, Independent samples T-Test, p=0.026). There was no significant age difference between the low back and the leg pain groups (Independent Samples T-Test, p=0.124).

Age: No correlation was observed between age and VAS or ODI (Pearson Correlation, respectively p= 0.125, r(df)= -0.263; p= 0.089, r(df)=0.306).

Gender: While there was a significant difference between the mean preoperative VAS scores of the gender groups (Independent Samples

T-Test, p:0.017, M: 7.10±1.10, F: 8.00±0.45), there was no difference between the mean ODI scores (Independent Samples T-Test, p:0.316, M:36.60±3.53, F:37.45±4.39).

Early Postoperative Period

General findings

In the early post-treatment evaluation, the VAS value of the patients' main complaint was 4.40±1.73. Nine out of 21 patients experienced clinically significant relief (a decrease of at least 2 points). The decrease in VAS values was statistically significant (Paired sample t-test, $p < 0.001$).

Comparative findings

Pain Localization: Clinically significant relief was observed in 15 out of 16 patients with predominant low back pain (93.75%) and 4 out of 5 patients with predominant leg pain (80%). This difference was not statistically significant (Fisher's Exact Test, p=0.429). However, there was a significant difference in VAS values according to predominant pain localization in the early postoperative period (Low back pain group VAS 3.94±1.53, Leg pain group VAS 5.60±1.82, Independent Samples T-Test, p=0.028).

Age: In the early postoperative period, no significant difference was observed between age and treatment success (Independent T-Test, p=0.133).

Gender: In the early postoperative period, no significant difference was observed between gender and treatment success (Fisher's Exact Test, p=0.738).

Postoperative 1st Month

General findings

The first patient was lost to follow-up and was never evaluated after discharge.The average VAS value of the patients' main complaints was 3.75±1.78 in the 1st month of control. The decrease in VAS values compared to preoperative scores was statistically significant (Paired sample t-test, $p < 0.001$). At the end of the first month, the mean ODI value was 29.40±5.70. The decrease in ODI was significant (Paired sample t-test, $p< 0.001$). The highest ODI score decrease was 14 points in the first postoperative month. However, there are 11 patients with ODI scores regressed below 31. Of these, two patients improved their ODI score by 37% or more.

Comparative findings

Pain Localization: Fifteen out of 16 patients with predominant low back pain (93.75%) and 3 out of 4 patients with predominant leg pain (75%) experienced clinically significant relief. This difference wasn't statistically significant (Fisher's Exact Test, p=0.368). There was no significant difference in VAS values according to predominant pain localization (Low back pain VAS 3.50±1.75, Leg pain VAS 4.75±1.71, Independent T-Test, p=0.108). There was also no significant difference in ODI values according to predominant pain localization at the first-month follow-up (Independent T-Test, p=0.163).

Age: No significant difference was observed between age and treatment success in the 1st first-month follow-up (Independent samples T-Test, p=0.094). In addition, no correlation was observed between age and VAS or ODI in the first month (Pearson Correlation, respectively p= 0.371, r(df)= 0.211; p= 0.076, r(df)= 0.406).

Gender: No significant difference was observed between gender and treatment success in the first-month follow-up (Fisher's Exact Test, p=0.368). Also, there were no significant differences in gender groups regarding VAS or ODI in the first month (Independent T-Test, respectively, p= 0.271; p= 0.440).

Postoperative 3rd Month

General findings

The mean VAS values of the patients' main complaints were 3.10±2.20 in the third-month follow-up. The decrease in VAS values was statistically significant (Paired sample t-test; from preoperative to 3rd month $p < 0.001$; from 1st month to 3rd month p=0.031). The mean ODI value was 26.20±5.65 at the end of the third month. The decrease in ODI points was significant (Paired sample t-test; $p < 0.001$). The highest ODI score decrease was 18 points in the third postoperative month. However, 13 patients with ODI scores regressed below 31. Of these, 7 improved their ODI score by 37% or more.

Comparative findings

Pain Localization: At the end of the third month, there were 18 patients whose VAS levels of main complaint decreased by 2 points or more (successful). Both patients whose VAS score of main complaint decreased 0-1 point (unsuccessful) were mainly complaining of leg pain and underwent surgery (one was lumbar discectomy; the other was dorsal root ganglion radiofrequency and knee surgery) in the later period **(Table 1)**.

The data at the end of the third month showed a significant difference in treatment success between patients with the main complaint of low back and leg pain (Fisher's Exact Test, p=0.032). There was also a significant difference in VAS values according to predominant pain localization in the early postoperative period (Low back pain VAS 2.69±1.92, Leg pain VAS 4.75±2.75, Independent T-Test, p=0.047).

There was a significant difference in ODI values according to predominant pain localization at the third-month follow-up. (Low back pain ODI 24.63±5.20, Leg pain ODI 32.50±1.00, Independent T-Test, p< 0.001).

Age: A significant difference was observed between age and treatment success in the third-month follow-up. (Independent T-Test, p=0.027). No correlation was found between age and VAS; however, there was a weak positive correlation between age and ODI in the 3rd month (Pearson Correlation, respectively p= 0.271, *r*(pdf)= 0.258; p= 0.036, *r*(pdf)= 0.471).

Gender: There was no significant difference between gender and treatment success in the third-month follow-up. (Fisher's Exact Test, p=0.237). Also, there were no significant differences in gender groups in terms of VAS or ODI in the 3rd month (Independent T-Test, respectively p= 0.423; p= 0.381)

Postoperative +10 Years

General findings

During the 10-year follow-up, 10 of 21 patients were lost to follow-up. Three out of the 11 patients who completed at least 10-year follow-up period underwent additional procedures (two underwent lumbar discectomy, the other was dorsal root ganglion radiofrequency and knee surgery). Among these three patients, who were considered unsuccessful cases, two had leg pain as their main complaint, while one had low back pain These patients were considered the unsuccessful treatment group at year 10. The mean ODI of the remaining eight patients at the end of the 10 years was 5.25±8.14 (Paired sample t-test; p < 0.001). While the decrease in ODI score was 19 points or more in seven of the eight patients who completed their 10-year follow-up without any additional surgery, it was 16 points in one patient. However, this patient was considered successful because there was more than 37% improvement (42%) and less than a final score of 31 (10). The Triple Likert scale results of 6 of these eight patients were three, while the remaining two were 2.

Comparative findings

Pain Localization: There was also no significant difference in ODI values according to predominant pain localization at the end of the ten-year follow-up (Independent sample t-test, p: 0.274). Additionally, no difference in success was observed between the low back and leg pain groups (Fisher's Exact Test, p:0.279).

Age: A significant difference was observed between age and treatment success in the 10th year of control (Independent Samples T-Test, p=0.018). However, there was a high positive correlation between age and ODI in the 10th year (Pearson Correlation, p= 0.011, *r*(df)= 0.828).

Gender: There was no significant difference between gender and treatment success at the in the 10th year of follow-up (Fisher's Exact Test, p:0.661). Also, there were no significant differences in gender groups regarding ODI in the 10th year (Independent T-Test, respectively p= 0.164).

DISCUSSION

The use of minimally invasive procedures for treating lumbar disc herniation began with the development of chymopapain chemonucleolysis in 1964 and has continued to increase in popularity (6, 11 - 13). There are few prospective case studies. Choy et al. (14) reported a 78,4% success

rate for PLDD in 333 patients after 26 months of follow-up. An early study of the KTP/532 device by Davis reported a success rate of 85% (15). Also, in a retrospective case series involving 27 patients, the results demonstrated a reduction in pain, with the VAS score decreasing from a preoperative score of 8.1 to a postoperative score of 3.1 (4). The success rate of percutaneous laser disc decompression was determined to be 90% for the first three months based on the decrease in VAS values and 72.73% for the ten years, according to the Oswestry Disability Index, consistent with findings from other studies.

There have been many clinical studies examining the use of PLDD. However, only very few controlled studies have been published to date, and due to the clinical heterogeneity, it is impossible to perform a meta-analysis of these series (16). Although our results are not definitive, they provide information that can be used in selecting patients for PLDD. In this study, we concluded that long-term follow-up results may be better in younger patients (the 10-year ODI points decreased better in younger patients, p=0.018).

We observed that patients with greater back pain than leg pain (16 patients in the first three months, six patients in 10 years) had a better response to the treatment than the patients whose leg pain was greater than their back pain (2 patients in the first three months and 10-year period, **Table 1**). The findings were statistically significant for the first three months (0.032), not statistically significant, but remarkable for 10-year follow-up (p=0.274). This data contradicts the classic doctrine of lumbar herniated disc surgery; the ones who experience more leg pain than back pain benefit more than the ones whose back pain is worse than their leg pain. This conclusion aligns with the findings of Hashemi et al., who reported similar outcomes in a series of 20 patients (2).

According to the results of our report, PLDD is most likely an appropriate treatment option for young patients with "contained" lumbar disc herniation and significant low back pain. These patients should also have disc heights that have not decreased by more than 30% and no neurological deficits. Our findings may serve as a guideline for enrollment in larger case series.

Some potential complications of the PLDD procedure include cauda equina syndrome, as well as perforation of the aorta, inferior vena cava, iliac veins, or abdominal cavity. However, complication rates are relatively low in PLDD studies. The only complication reported in a study of 333 patients published by Choy was a case of discitis (14). Consequently, our high success rate (90.0% for the first three months, %72.73 for ten years) and lack of complications are compatible with the results of more extensive, published case series. A study comparing 86 patients who underwent PLDD with 162 patients who underwent endoscopic discectomy found that while PLDD was successful in the short term, its effectiveness diminished over the long-term follow-up period of 17 months. (13). This report's small sample size (21 patients) restricts us from reaching a general conclusion. A more extended study with a larger sample size will give us a better idea of the efficacy of PLDD.

In conclusion, the success rate of PLDD is 90.0% for the first three months %72.73 for ten years. For patients with contained disc herniation who are significantly suffering from low back pain, PLDD appears beneficial. The advantages of this technique include the ease of use and the fact that it can be performed as an outpatient procedure.

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