Photomedicine and Laser Surgery
Volume 24, Number 6, 2006

Pp. 694–697
DOI: 10.1089/PHO.2006.2039

Comparison of Results of 500 Microdiscectomies and 500 Percutaneous Laser Disc Decompression Procedures for Lumbar Disc Herniation

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ABSTRACT

Objective: **This article aimed to analyze the neurosurgical results of 500 patients treated with microdiscectomies and 500 patients treated with percutaneous laser disc decompression.** ***Background Data:*** **It has been suggested in the literature that percutaneous laser disc decompression might be considered a serious and valid alternative to microdiscectomy in the treatment of patients with discogenic pain caused by herniated lumbar disc.** ***Methods:*** **Patients with herniated discs were treated by microdiscectomy (*n* = 500) according to the Caspar technique, and patients with discogenic pain were treated with percutaneous laser disc decompression (*n* = 500) according to the Choy technique. The inclusion and exclusion criteria were the same for both groups of patients. Age, gender distribution, multiple levels involved, and associated pathologies were not statistically different. The results were evaluated for both groups with the MacNab criteria. The follow-up period was 2 years (±1 year).** ***Results:*** **In the microdiscectomy group, 85.6% of patients (*n* = 428) had a good or excellent outcome; in the percutaneous laser disc decompression group, 83.8% of patients (*n* = 419) had a good or excellent outcome. Complications occurred in 2.2% (*n* = 11) in the microdiscectomy group and in 0% in the percutaneous laser disc decompression group.** ***Conclusion:*** **The analysis of results for the two groups supports the conclusion that percutaneous laser disc decompression is a safe, minimally invasive, and strong alternative treatment to microdiscectomy in patients affected by herniated discs.**

INTRODUCTION

MINIMALLY INVASIVE spine techniques have proliferated during the past 10 years. Microdiscectomy, which began nearly 30 years ago,[2–15] was the first minimally invasive surgical approach for herniated discs. Percutaneous laser disc decompression (PLDD), which began 20 years ago,[4] represents an even less invasive surgical technique for discogenic pain caused by protrusion or herniation of the intervertebral disc. The author, a neurosurgeon, began his experience in the treatment of lumbar herniated discs using microdiscectomy, according to the Caspar technique 15 years ago, and using PLDD, according to the Choy technique, 3 years ago.[6–13] The neurosurgical point of view regarding disc surgery is that microsurgery continues to be the better treatment for patients for discogenic pain. There is a consensus that microdiscectomy has improved outcome results and, from the beginning, has been of paramount importance in the treatment of disc hernias.

The pioneering work of Choy with lasers in the early 1980s led to the use of laser energy to achieve nerve decompression, by vaporizing a small amount of the disc's nucleus pulposus percutaneously. This work has had considerable resonance. In the years before the advent of PLDD, nucleotomy using a percutaneous intradiscal injection of chemopapain was tried, but it led to a small percentage of severe complications, including anaphylactic shock reaction and even death. Intradiscal electroteraphy (IDET) and other similar techniques have been tried in recent years, but no large series study with long follow-up has yet been reported. The many advances in modern minimally invasive spine treatments have arisen out of the need to avoid tissue trauma and to reduce the relatively high rate of complications and repeated surgery—all of which entail high

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costs in terms of medical resources and the patient's recovery. A large number of studies have reported the results of microdiscectomies, several scientific publications of Choy[7] and Hellinger[9] have discussed and analyzed the results in a large consecutive series of patients treated with a follow-up of over 7 years, but no previous studies have compared the results of these two techniques in a large consecutive series with a follow-up period of 2 years until now. This study has enabled us to compare the results, complications, recurrence rate, and recovery time of these two important procedures for patients affected by discogenic pain caused by disc hernia, and to discuss the main technical problems with the PLDD procedure.

METHODS

Subjects consisted of two groups of 500 patients: a microdiscectomy group and a PLDD group (group 1 and group 2, respectively). All patients in both groups were unresponsive to standard conservative therapies for 6 weeks. The microdiscectomy series comes from the Neurosurgical Department of Teramo City Hospital (Italy), and these patients were treated according to Caspar's technique by six different neurosurgeons (including the author), between January 1997 and December 2001. The PLDD patients were treated according to Choy's technique by the author between December 2002 and November 2004. The inclusion criterion was the same for both groups: pain due to lumbar herniated disc not responsive after 6 weeks of conservative therapies. Those with sequestered discs were excluded in both groups. There were 28 patients with diabetes mellitus in group 1 and 31 in group 2. There were 31 patients with previous failed back open surgery in group 1 and 39 in group 2. Age ranged from 16 to 79 years (median age of 47 years) for group 1 and from 17 to 82 years (median age 49 years) for group 2. The gender distribution was 239 females and 261 males in the microdiscectomy series and 247 females and 253 males in the PLDD series. The lumbar level involved was as follows: Group 1: 222 at L4-L5, 214 at L5-S1, 94 at L3-L4, 34 at L2-L3, and five at L1-L2; Group 2: 238 at L4-L5, 210 at L5-S1, 111 at L3-L4, 32 at L2-L3, and six at L1-L2. Sixty-nine patients had multiple levels (no more than 2 levels) in group 1, as did 97 patients in group 2 (Tables 1 and 2).

The time duration of the microdiscectomy procedure ranged from 1 h to 2 h 15 min, and the PLDD procedure took from 30 min to 1 h 10 min. All PLDD procedures were performed with the neodymium:yttrium-aluminium-garnet (Nd:YAG) 1,064-nm laser (DEKA M.E.L.A., Calenzano, Florence, Italy) and with single-use 400-μm optical fibers with a thin, hard, cover jacket (Eufoton, Trieste, Italy) so that, during the lasing, the virtual space between the internal needle walls and the optical fiber was sufficient to allow a partial loss of heat. The power used was 13–20 W, with a total delivery of 800–1500 Joules. The single laser beam power was related to the height of the disc, whereas the total laser energy delivered was related to the height of the patient. The pause time between each laser beam was 5–7 sec. During each PLDD procedure, the optical fiber was retracted three to four times to allow the heat to dissipate, and to check the correct function of the optical fiber's tip and the round shape of the spot. The needle used was 18-gauge (Becton Dickinson, Franklin Lakes, NJ). In 14 patients with L5-S1 disc hernia, we performed an extratechal paramedian approach according to the Choy technique.[5] In the microdiscectomy group, only a short antibiotic therapy after surgery was used (cefuroxime 1 g i.m. every 12 h for 3 days). In the PLDD group, we used cefuroxime (1 g i.m at 12 h before and 1 g i.m. at 12 h after procedure) and vancomycin (500 mg in 500 cc of saline solution at 1 h before the procedure). All patients treated with PLDD were mildly sedated with 10 mg of diazepam i.m. All patients in both groups were preoperatively studied with lumbar magnetic resonance imaging (MRI) and/or computed tomography (CT) scan. An electromyogram (EMG) study was preoperatively performed in 38% (n = 190) in group 1 and in 29% (n = 145) in group 2. The neurological examination, before surgery, showed important signs in group 1 as follows: foot drop in 1.6% (n = 8), important sensory impairment in 18.4% (n = 92), reflex absence in 8% (n = 40), and straight leg raising in 95% (n = 475). The neurological signs, before PLDD, in group 2, foot drop in 1.2% (n = 6), severe sensory impairment in 22% (n = 110), reflex absence in 6.6% (n = 33), straight leg raising in 92.8% (n = 464), and impotence in 0.2% (n = 1).

Table 1. Multiple Level Cases in the PLDD Group

Multiple levels	*No. of cases*
(L3-L4) + (L4-L5)	36
(L3-L4) + (L5-S1)	10
(L4-L5) + (L5-S1)	51

Table 2. Multiple Level Cases in the Microdiscectomy Group

Multiple levels	*No. of cases*
(L3-L4) + (L4-L5)	29
(L3-L4) + (L5-S1)	3
(L4-L5) + (L5-S1)	37

Data analysis

The results were evaluated with the MacNab criteria for both groups (with only telephone interview in 0.8% in group 1 and in 0.7% in group 2). The follow-up period was 2 years (±1 year).

RESULTS

Using the MacNab criteria, the results were as follows; microdiscectomy group: 85.7% (n = 428) showed an excellent or good outcome, whereas 14.4% (n = 72) showed no change or poor outcome (Table 3). In the PLDD group, 83.8% (n = 419) showed an excellent or good outcome, and 16.2% (n = 81) showed no change or poor outcome. The improvement came more quickly in the microdiscectomy group than in the PLDD group: immediately for 85% in group 1 and 67% in group 2; after 1–2 weeks for 7% and 12%, respectively; after 3–10 weeks for 5% and 16%, respectively. No complications occurred in

Table 3. Results (MacNab Criteria)

Microdiscectomy group	*PLDD group*
Overall good/excellent 428 patients (85.7%)	419 patients (83.8%)
Poor/no results 72 patients (14.3%)	Poor/no results 81 patients (16.2%)

the PLDD group (in a female patient, fever with back pain began 3 days after procedure, but remitted after 1 week of antibiotics and bed rest).

The improvement in remission of important neurological signs was as follows: Group 1: foot drop improved or remitted in 50% of patients ($n = 4$), sensory deficit improved or remitted in 75% ($n = 69$), reflex recovery was found in 70% ($n = 28$), straight leg raising remitted in 88% ($n = 418$); Group 2: foot drop improvement or remitted in 65% ($n = 4$), sensory deficit improved or remitted in 80% ($n = 88$), reflex absence remitted in 73% ($n = 24$), straight leg raising remitted in 91% ($n = 422$), and one patient with impotence recovered after 3 months. In the microdiscectomy group, the overall complications rate was 2.2% ($n = 11$): 0.6% ($n = 3$) had spondylodiscitis, 0.4% ($n = 2$) had perineural haematoma requiring early new open surgery, 0.4% ($n = 2$) had neurological radicular deterioration, and 0.8% ($n = 4$) had spondylolisthesis requiring vertebral stabilization. The repeat procedure rate for reherniation or persistent back or leg pain was 7% ($n = 35$) in group 1 and 3.2% ($n = 16$) in group 2. The median hospital stay was 6 days (range 4–10 days) in group 1, and 2 days (range 1–3 days) in group 2. The difference in the recovery time was very significant: a median of nearly 60 days (range 30–95 days) in group 1, with 1% ($n = 5$) of patients unable to return to their jobs, and a median of 35 days (range of 10–45 days) in group 2.

DISCUSSION

This is the first study to compare the results of a large consecutive series of patients treated with microdiscectomy and patients treated with PLDD for disc hernia. The follow-up of 2 years (± 1 year) is not very long and will be updated it in the coming years. Neurosurgeons well know that failed back surgery for disc hernia can become evident only after 5 or 10 years. Neurosurgeons, orthopedist and other medical specialists involved in discogenic pain management are aware that a realistic rate of successful treatment of disc hernia with microdiscectomy is 75–80%.[8–11] The proliferation of minimally invasive spine surgery techniques during the past 10 years is an implicit answer to this problem.[14] In general, the successful treatment of discogenic pain syndrome is very challenging, and more scientific studies on the spine and on disc biomechanic-chemical physiopathology are needed.[3,10,12] The perfect intranuclear tip needle position in the PLDD procedure is of paramount importance to achieve a successful nerve decompression effect. This is more difficult to achieve in the L5-S1 disc due to its slanting orientation. Patients with disc hernia originating from a dehydrated disc (called "black disc" at MRI) have not significative statistical difference in outcome whereas patients with also small intradiscal gas bubbles have less chance of obtaining a good outcome. Patients with prior failed back open surgery (microdiscectomy or discectomy) have less chance of achieving good or excellent results with open surgery, and this is even evident with the PLDD procedure. Patients with reduced height of the treated intervertebral disc have worse results with PLDD. The morbidity rate is lower in the PLDD group (0% in the author's experience; 0.4–1% in other very impressive series) than in the microsurgery group one (2.2%). The recovery time in successful cases is very short in the PLDD group, even if the pain recovery time is longer in the PLDD group than in the microdiscectomy group: 79% and 92%, respectively, within 2 weeks. The recurrence rate and need for new treatment is less lower in the PLDD group (3.2% versus 7%). These two last data entail the important consideration that failed back open surgery is often followed by the need for fusion and stabilization surgery, which entail larger economic and social costs in the microdiscectomy group than in the PLDD group.[1]

CONCLUSION

We have not demonstrated that PLDD is better than microdiscectomy or vice versa, but we can conclude that PLDD, with its background data and the results of 19 years, represents a strong, successful, and safe first choice of a minimally invasive technique in the treatment of patients affected by discogenic pain for disc hernia that was not responsive to the standard conservative therapies.

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