Review Article

Should anyone perform percutaneous endoscopic laser diskectomy and percutaneous lumbar disc decompressions?

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Abstract

**Background:** Increasingly, pain management specialists (P-S) (e.g., anesthesiologists, radiologists, or physiatrists), who are not spinal surgeons, are performing percutaneous endoscopic laser diskectomy (PELD), percutaneous lumbar disc decompression (PLDD), and target percutaneous laser disc decompression (T-PLDD) in patients with minimal/mild disc herniations. Here, theoretically, the laser vaporizes/shrinks a small portion of disc tissue that lowers intradiscal pressure/volume, and thereby provides “symptomatic relief” (e.g., low back pain/ radiculopathy). Nevertheless, the vast majority of these patients experience spontaneous relief of their complaints over several months without any intervention.

**Methods:** A literature review revealed that P-S specialists are performing PELD/PLDD/T-PLDD to address minimal/mild disc herniations. However, multiple well-designed studies confirmed that PELD/PLDD/T-PLDD were ineffective for managing acute/chronic pain in these patients.

**Results:** Several randomized clinical trials documented the lack of clinical efficacy of PELD/PLDD/T-PLDD procedures over microdiskectomy. PELD/PLDD/T-PLDD correlated with only 60–70% success rates with higher reoperation rates (e.g., up to 38%) vs. 90% success rates for routine microdiskectomy (e.g., with faster recovery and only 16% reoperation rates). Nevertheless, without surgical training, P-S are performing these procedures and are, therefore, unable to address perioperative/postoperative PELD/PLDD/T-PLDD surgical complications.

**Conclusions:** Pain management specialists, who are not trained spinal surgeons, should not perform PELD/PLDD/T-PLDD surgery to treat minimal/mild disc herniations. Not only do most of these discs resolve spontaneously over several months but also they are largely ineffective. Furthermore, there is no evidence to support the superiority of PELD/PLDD/T-PLDD procedures over microdiskectomy even if performed by spinal specialists.

**Key Words:** Pain management specialists: Not surgeons, percutaneous lumbar endoscopic diskectomy, spinal surgery

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INTRODUCTION

Should pain management specialists (P-S) (e.g., anesthesiologists, radiologists, and physiatrists), who are not spine surgeons, perform percutaneous endoscopic laser discectomy (PELD), percutaneous lumbar disc decompression (PLDD), and target percutaneous laser disc decompression (T-PLDD) for minimal/mild disc herniations? Here, in theory, the laser vaporizes/shrinks a small portion of disc tissue that lowers the intradiscal pressure/volume, and provides “symptomatic relief” of low back pain/radiculopathy. However, the natural history for these minimal/mild disc herniations is that the vast majority spontaneously resolve over several months without any intervention. Furthermore, when “surgery” is indicated, several well-designed studies have shown that PELD/PLDD/T-PLDD are ineffective in the management of acute/chronic pain in patients with minimal/mild lumbar disc herniations and have lower success rates (60–70%) and higher reoperation rates (38%) vs. routine microdiscectomy [e.g., 90% success rates/faster recovery rates and fewer reoperations (16% rates)].

Natural history of lumbar disc herniations: The majority spontaneously improve

Many patients with unilateral radiculopathy due to minimal/mild disc bulges experience spontaneous clinical/radiographic [magnetic resonance (MR)-documented] improvement of their discopathy/radiculopathy without PELD/PLDD/T-PLDD. In a study by Komori et al., most symptomatic lumbar disc herniations (100% radiolucent 94% SLR positive, 32% motor deficits) spontaneously regressed (e.g., without surgery) on sequential MR studies performed over an average interval of 150 days. Later, Casey et al. stated that “most cases of radiculopathy were self-limiting, and symptoms resolved over the course of weeks to months.”

Pain management specialists perform percutaneous injections, including epidural spinal injections, but are not spinal surgeons

In a commentary in 2013, Epstein noted that P-S perform multiple unnecessary epidural spinal injections (ESI) that are “typically short-acting and ineffective over the longer-term.” [9] Reports of contaminated ESI from the Center for Disease Control (CDC) in 2012/2013 documented “25 deaths (many due to Aspergillosis), while 357 patients sickened, and 14,000 were exposed to contaminated steroids.” Additional morbidity/mortality attributed to ESI included “spinal fluid leaks (0.4–6%), positional headaches (28%), adhesive arachnoiditis (6–16%), hydrocephalus, air embolism, urinary retention, allergic reactions, intravascular injections (7.9–11.6%), stroke, blindness, neurological deficits/paralysis, hematomas, seizures, and death.” [6]

Although, P-S have experience with various percutaneous injection techniques/ESI/rhizotomies), they are not spinal surgeons (e.g., did not complete neurosurgical/orthopedic residency training programs), and are, therefore, not adequately trained to perform spinal surgery.

“Pros” for PELD/PLDD/T-PLDD based on studies without clinical control groups or independent observers

Several poorly designed studies without clinical control groups or independent observers, documented the safety/efficacy/outcomes of PELD/PLDD/T-PLDD [Tables 1 and 2]. In 2004, Sobieraj et al. evaluated the clinical efficacy of 212 PLDD performed for lumbar pain/radiculopathy; although 79.2% experienced a reduction in pain over the first 6 postoperative weeks, 3.8% deteriorated due to “inflammation” [Table 2]. Interestingly, the authors concluded that PLDD were appropriate for only “slight” herniated discs, but should only be performed as a “last attempt” for those with larger disc herniations, and only if the posterior longitudinal ligament (PLL) was intact. Maksymowicz et al., in 2004, noted that PLDD through “vaporization and ablation of a small amount of tissue from the nucleus pulposus” could reduce intradiscal pressure and root compression (e.g., typically without confirmation of either result), relieving 75% of the symptoms [Table 2]. Notable contraindication to PLDD included sequestrated discs, underlying coagulopathies, and bacterial infection. In 2007, Ishiwata et al. documented a 68.8% success rate for MR imaging-guided laser-tip PLDD performed for 32 patients (average age of 35 years) with back pain/monoradiculopathy without neurological deficits [Table 2]. In 2011, Lee and Lee utilized the carbon dioxide (CO₂) laser to perform microdiskectomies (average age of 62.2 years) at the L5-S1 level; immediately postoperatively, 27 of 28 patients improved (e.g., 1 transient dysesthesia), one year later, average VAS/ODI scores decreased significantly, and they declared “clinical success” in 27 patients (96.4%), none of who required secondary surgery or fusions [Table 2]. In 2012, Zhao et al. utilized C-arm fluoroscopy to perform 25 PLDD using the Nd:YAG laser; success rates were 92.0% and 92.0% (MacNab’s criteria) at 6 and 12 months, respectively, and there were no complications [Table 1]. The authors concluded that “T-PLDD can significantly decrease pain and improve function of patients who have extruded but nonsequestrated lumbar intervertebral disc herniations.” Over a 3 year period, Ren et al. (2013) performed 80 PLDD in 42 patients utilizing the Nd:YAG laser in two age groups (Group I: 19 patients ≤45 years old, and Group II: 23 patients >45 years old) [Table 1]. Outcomes were similar for both age groups at 3–56 postoperative months, and there were complications. Notably, none of these series included control groups or independent observers to validate their extraordinarily positive conclusions.
Treatment with PLDD fails to demonstrate loss of disc height on radiographic studies

Ren et al. evaluated the medium-term results of neuroaroidiological imaging following 22 PLDD, looking for confirmation of loss of disc height [Table 1]. They found that although “PLDD did not obviously lower the height of the intervertebral space, instead it could effectively promote the reduction of disc herniation.”

“Cons,” including lack of efficacy, of PELD/PLDD/T-PLDD substantiated in multiple well-designed prospective randomized trials

Multiple prospective randomized trials documented the lack of efficacy of PELD/PLDD/T-PLDD alone or compared with microdiscectomy. In 2007, Goupille et al. looked at multiple PELD/PLDD studies (1980–2006) in the MEDLINE EMBASE databases [Table 2]. They found no uniformity in the technical performance of these procedures due to the “lack of control studies,” and concluded that “this treatment cannot be considered validated for disc herniation-associated radiculopathy resistant to medical treatment” [Table 2]. In a randomized controlled trial, Postacchini and Postacchini noted transfominal endoscopic discectomy yielded comparable results vs. routine microdiscectomy, as long as the “surgeon is expert enough in the technique, which implies a long learning curve in order to perform the operation effectively, with no complications” [Table 1]. However, they noted that the “success rate ranges from 60 to 70% for the former vs. 90% seen with microdiscectomy.” Utilizing multiple major databases, Singh et al. looked at the efficacy of PELD in treating lumbar disc/radiculopathy [Table 1]. They concluded “although laser diskectomy has been utilized for many years, there is a paucity of randomized clinical trials,” and therefore, “this systematic review shows limited evidence to support the use of percutaneous lumbar laser disc decompression.” Brouwer et al., in 2015, in a randomized/prospective trial of 115 patients with sciatica/lumbar discs (8 hospitals in the Netherlands) occupying less than one-third of the spinal canal, performed PLDD (57 patients) (FDA approved 1991) vs. routine microdiscectomy (58 patients) [Table 1]. Although the Roland-Morris Disability Questionnaire (RDQ) “showed non-inferiority (e.g., not worse) of PLDD at 8 and 52 weeks” vs. conventional surgery, those undergoing microdiscectomy recovered more quickly and required fewer reoperations (38% PLDD versus 16% microdiscectomy).
### Table 2: Summary of laser discectomy literature (2004-2011)

| Author          | Procedure/Surgery                                      | Results of PELD                                                                 | Conclusion                                      |
|-----------------|--------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------|
| Lee et al.[10]  | 31 consecutive patients EFLDH at L5S1 Carbon dioxide (CO₂) laser-assisted microdiscectomy for extraforaminal lumbar disc herniation at the L5-S1 level-lateral transmuscular route | This technique may not effectively remove foraminal lumbar disc herniation (FLDH), resulting in persistent leg pain and need for revision surgery | Satisfactory surgical results at the 1-year follow-up |
| Postacchini et al.[11] 2011 | Microdiscectomy: 90% effective Laser discectomy: 60 to 70% effective | Faster recovery Lower reoperation rate with microdiscectomy | 60–70% success with laser discectomy-longer recovery |
| Ay et al.[1] 2011 | Compared effectiveness of low-level laser therapy (LLLT) on pain/function for acute and chronic lumbar disk herniation (LDH). Random assignments: Hot Pack/Laser Group 1 (acute LDH, n=20) Group 2 (chronic LDH, n=20) Hot Pack/Placebo Group 3; (acute LDH, n=20) Group 4: (chronic LDH, n=20) | 15 Sessions; 3 weeks No significant differences between 4 groups Same outcomes | No differences between laser and placebo on pain severity and functional capacity for acute and chronic disc herniations |
| Ishiwata et al.[12] 2007 | MR guided PELD relationship between clinical results and needle tip location Single-level contained focal disk herniation | Success: 27 patients with needle tip in DL quadrant; 70.4%. 14 patients with needle tip in middle zone showed a favorable outcome (77.8%) | Middle zone in the DL quadrant of the targeted disk space Favorable target -better outcomes. Overall success rate PLDD 68.8% |
| Maksymowicz et al.[13] 2004 | PLDD Vaporization and ablation of small amount of tissue from the nucleus pulposus. Significant reduction in pressure in disc (closed space) | PLDD effective in 75% of low back pain reduction of symptoms | One-stage Treatment-multi level discs Contraindications for PLDD: Sequestrated disc Coagulation abnormality Infection |
| Sobieraj et al.[14] 2004 | Prospective PLDD in 212 patients with discopathic lumbar pain. PLDD is not an alternative to open surgery-different classifications (e.g., PLLD more minimal discs) | PLDD: 79.2% resolution or significant reduction of pain PLDD last attempt MIS if no disruption posterior longitudinal ligament | PLDD is not an alternative to open surgery on lumbar discopathy |

**PELD/PLDD ineffective in managing acute/chronic pain in a clinical randomized double blind placebo-controlled trial versus experimental dog model**

In a randomized, double blind, placebo-controlled trial, Ay et al. determined that low-level laser therapy (LLT) proved of no benefit (was ineffective) for patients with acute/chronic pain attributed to lumbar disc herniations (LDH) [Table 2].[11] In this study, 4 groups of patients (20 patients per group) with LDH were treated for 15 sessions over a 3-week period; Group 1 (acute) and Group 2 (chronic) patients both received hot-pack/laser therapy; Group 3 (acute) and Group 4 (chronic) patients both received hot-pack/placebo laser therapy. Notably, all patients demonstrated comparable outcomes, and “there were no differences between laser and placebo laser treatments on pain severity and functional capacity in patients with acute and chronic low back pain caused by LDH.” Unlike the clinical experience, when Draper et al. studied 36 dogs with acute paraparesis caused by disc herniations, following disc resection, those dogs undergoing additional low level postoperative laser therapy ambulated sooner [Table 1].[15]

**SUMMARY**

Pain management specialists, who are not spinal surgeons, are increasingly performing PELD/PLDD/T-PLDD operations for minimal/minor lumbar disc herniations, which many contend, would resolve spontaneously over several months duration. Furthermore, the “pros” for these procedures comes from typically poorly designed clinical studies, without controls or independent evaluators.[4,8,10,11,13,16,17] Alternatively, the “cons” the (e.g., lack of efficacy of these PELD/PLDD/T-PLDD operations) against these procedures have been
well-established in multiple well-designed prospective randomized clinical trials [Tables 1 and 2].[1,2,7,10,12,15] We then ask, should pain management specialists or even spine surgeons perform PELD/PLDD/T-PLDD: What do you think?

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Conflicts of interest
There are no conflicts of interest.

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