Policy Number	**SUR712.004**
Policy Effective Date	**10/15/2025**

Automated Percutaneous Discectomy and Percutaneous Endoscopic Discectomy

Table of Contents

Related Policies (if applicable)
None

Disclaimer

Carefully check state regulations and/or the member contract.
Each benefit plan, summary plan description or contract defines which services are covered, which services are excluded, and which services are subject to dollar caps or other limitations, conditions or exclusions. Members and their providers have the responsibility for consulting the member's benefit plan, summary plan description or contract to determine if there are any exclusions or other benefit limitations applicable to this service or supply. **If there is a discrepancy between a Medical Policy and a member's benefit plan, summary plan description or contract, the benefit plan, summary plan description or contract will govern.**

Coverage

Automated percutaneous discectomy **is considered experimental, investigational and/or unproven** as a technique of intervertebral disc decompression in individuals with back pain and/or radiculopathy related to disc herniation in the lumbar, thoracic, or cervical spine.

Percutaneous endoscopic discectomy **is considered experimental, investigational and/or unproven** as a technique of intervertebral disc decompression in individuals with back pain and/or radiculopathy related to disc herniation in the lumbar, thoracic, or cervical spine.

NOTE: This policy does not address endoscopic foraminotomy alone (without discectomy).

Policy Guidelines

None.

Description

Surgical management of herniated intervertebral discs most commonly involves discectomy or microdiscectomy, performed manually through an open incision. Automated percutaneous discectomy involves placement of a probe within the intervertebral disc under image guidance with aspiration of disc material using a suction cutting device. Endoscopic discectomy involves the percutaneous placement of a working channel under image guidance, followed by visualization of the working space and instruments through an endoscope, and aspiration of disc material.

Background

Back pain or radiculopathy related to herniated discs is an extremely common condition and a frequent cause of chronic disability. Although many cases of acute low back pain and radiculopathy will resolve with conservative care, surgical decompression is often considered when the pain is unimproved after several months and is clearly neuropathic in origin, resulting from irritation of the nerve roots. Open surgical treatment typically consists of discectomy in which the extruding disc material is excised. When performed with an operating microscope, the procedure is known as microdiscectomy.

Minimally invasive options have also been researched, in which some portion of the disc material is removed or ablated, although these techniques are not precisely targeted at the offending extruding disc material. Ablative techniques include laser discectomy and radiofrequency (RF) decompression which are addressed in separate policies. Intradiscal electrothermal annuloplasty is another minimally invasive approach to low back pain. In this technique, RF energy is used to treat the surrounding disc annulus which is addressed in a separate policy.

Herein, this policy addresses automated percutaneous and endoscopic discectomy, in which the disc decompression is accomplished by the physical removal of disc material rather than its ablation. Traditionally, discectomy is performed manually through an open incision, using cutting forceps to remove nuclear material from within the disc annulus. This technique has been modified by automated devices that involve placement of a probe within the intervertebral disc and aspiration of disc material using a suction cutting device. Endoscopic techniques may be intradiscal or may involve the extraction of non-contained and sequestered disc fragments from inside the spinal canal using an interlaminar or transforaminal approach. Following insertion of the endoscope, the decompression is performed under visual control.

Regulatory Status

The Dekompressor® Percutaneous Discectomy Probe (Stryker), Herniatome Percutaneous Discectomy Device (Gallini Medical Devices), and the Nucleotome® (Clarus Medical) are examples of percutaneous discectomy devices that have been cleared for marketing by the U.S. Food and Drug Administration (FDA) through the 510(k) process. The FDA indication for these

products is for “aspiration of disc material during percutaneous discectomies in the lumbar, thoracic and cervical regions of the spine.” FDA product code: HRX.

A variety of endoscopes and associated surgical instruments have also been cleared for marketing by the FDA through the 510(k) process.

Rationale

Medical policies assess the clinical evidence to determine whether the use of a technology improves the net health outcome. Broadly defined, health outcomes are length of life, quality of life, and ability to function--including benefits and harms. Every clinical condition has specific outcomes that are important to patients and to managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens, and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of a technology, 2 domains are examined: the relevance and the quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy, however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

Automated Percutaneous Discectomy

Clinical Context and Therapy Purpose

The purpose of automated percutaneous discectomy is to provide a treatment option that is an alternative to or an improvement of existing therapies for individuals with herniated intervertebral disc(s).

The following PICO was used to select literature to inform this policy.

Populations

The relevant population of interest is individuals with herniated intervertebral disc(s).

Interventions

The therapy being considered is automated percutaneous discectomy.

Comparators

The following therapies and practices are currently being used to treat herniated intervertebral disc(s): conservative therapy and open discectomy or microdiscectomy.

Outcomes

The general outcomes of interest are symptoms, functional outcomes, quality of life, and treatment-related morbidity. Specific outcomes measured by specific instruments include improvements in functional outcomes assessed on the Oswestry Disability Index (ODI), reductions in pain using a visual analog scale (VAS), improvements in quality of life measured on the 36-Item Short-Form Health Survey (SF-36) and Euro-QOL-5D, and treatment-related morbidity including surgical success/failure and complications. To assess outcomes, follow-up at 1 year is considered appropriate.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs.
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess longer term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.
- Studies with duplicative or overlapping populations were excluded.

Systematic Reviews

Systematic reviews have assessed automated percutaneous discectomy compared to other interventions; however, the majority of these reviews contained observational studies published more than a decade ago with generally small patient populations and inconsistent results. Lewis et al. (2015) published the most recent systematic review and network meta-analysis comparing trials of 21 different treatment strategies for sciatica. (1) Examples of the 21 treatment strategies included in the analysis are conservative care, disc surgery, intraoperative interventions, epidural injections, biologic agents, and percutaneous discectomy. Under the category of "percutaneous discectomy," reviewers combined automated percutaneous discectomy, percutaneous automated nucleotomy, nucleoplasty, and laser discectomy. They searched 28 databases and trial registries through December 2009. Ninety studies were included and 10 involved the percutaneous discectomy category as an intervention. Of the 10, 4 are relevant to this medical policy: 2 case-control studies of percutaneous endoscopic discectomy (2006, 2007), 1 RCT of percutaneous endoscopic discectomy (1993), and 1 RCT of automated percutaneous discectomy (1995). The remaining studies were published in a foreign language or involved other comparators (nucleolysis and chemonucleolysis). The global effects odds ratio for the category of percutaneous discectomy compared with inactive control was 0.82 (95% confidence interval [CI], 0.39 to 1.72), which was inferior to disc surgery, epidural injections, and intraoperative interventions. The pain intensity weighted mean difference for the category of percutaneous discectomy compared with inactive control was 11.5 (95% CI, -18.6 to 41.6). Reviewers concluded that there was no support for the effectiveness of percutaneous discectomy for the treatment of sciatica. Due to the inclusion of additional

interventions into the broad category of percutaneous discectomy in this review, the relevance of these results to this medical policy is limited.

Randomized Controlled Trials

The 2002 Lumbar Automated Percutaneous Discectomy Outcomes Group (LAPDOG) trial was an RCT that compared automated percutaneous discectomy with open discectomy in patients with lumbar disc herniation. (2) No additional RCTs have been identified since the 2002 LAPDOG trial. The trial was designed to recruit 330 patients but enrolled 36 patients for reasons not readily apparent. Twenty-seven patients were available at follow-up, with efficacy reported by 41% of those undergoing automated percutaneous discectomy and by 40% of those undergoing conventional discectomy. The trialists concluded that "It is difficult to understand the remarkable persistence of percutaneous discectomy in the face of a virtually complete lack of scientific support for its effectiveness in treated lumbar disc herniation." The tables below more fully describe key characteristics, results, and limitations of the LAPDOG trial.

Table 1. Characteristics of the LAPDOG Trial

Study	Countries	Sites	Dates	Participants	Interventions
Haines et al. (2002) (2)	US, Canada	10	NR	Patients with predominantly unilateral leg pain or paresthesia with no previous treatment for lumbar spinal disease, at least 2 of 4 objective signs, and an imaging study confirming disc herniation at the appropriate level	Automated percutaneous discectomy vs. conventional discectomy

LAPDOG: Lumbar Automated Percutaneous Discectomy Outcomes Group; NR: not reported; US: United States.

Table 2. Results of the LAPDOG Trial

Study	Treatment success[a] (at 6 months)	Treatment failure[b] (at 6 months)	SF-36 Physical Functioning Subscore	SF-36 General Health Subscore	Modified Roland Score
Haines et al. (2002) (2)					
N	27	27	NR	NR	NR
Automated percutaneous discectomy	7 (41%)	10 (59%)	Pre- vs. postoperative mean difference: 35.7	Pre- vs. postoperative mean difference: 5.0	Pre- vs. postoperative mean difference: 9.7
Conventional discectomy	4 (40%)	6 (60%)	Pre- vs. postoperative mean	Pre- vs. postoperative mean	Pre- vs. postoperative mean

			difference: 36.1	difference: 8.0	difference: 10.6
p	.95	.95	.96	.58	.74

LAPDOG: Lumbar Automated Percutaneous Discectomy Outcomes Group; NR: not reported; SF-36: 36-Item Short-Form Health Survey.

[a] Success was defined as either an excellent or good result as defined by an outcome matrix.

[b] Failure was defined as not achieving success or requiring a second procedure during the follow-up period.

Table 3. Study Relevance Limitations of the LAPDOG Trial

Study	Population[a]	Intervention[b]	Comparator[c]	Outcomes[d]	Duration of Follow-up[e]
Haines et al. (2002) (2)	3. Investigators believed that study inclusion criteria reflected an existing population with lumbar disc disease; however, results from only 27 patients were eventually analyzed from a planned enrollment of 330 patients			4. Primary outcomes of "success" or "failure" largely subjective in nature; investigators admit that the outcome measurement tool used cannot be precisely reproduced	1, 2. Outcomes reported only for 6 months of follow-up; 12 month follow-up was achieved for only 19 patients and the study did not report any of these results

LAPDOG: Lumbar Automated Percutaneous Discectomy Outcomes Group.

The study limitations stated in this table are those notable in the current literature review; this is not a comprehensive gaps assessment.

[a] Population key: 1. Intended use population unclear; 2. Clinical context is unclear; 3. Study population is unclear; 4. Study population not representative of intended use; 5. Other.

[b] Intervention key: 1. Not clearly defined; 2. Version used unclear; 3. Delivery not similar intensity as comparator; 4.Not the intervention of interest; 5. Other.

[c] Comparator key: 1. Not clearly defined; 2. Not standard or optimal; 3. Delivery not similar intensity as intervention; 4. Not delivered effectively; 5. Other.

[d] Outcomes key: 1. Key health outcomes not addressed; 2. Physiologic measures, not validated

surrogates; 3. No CONSORT reporting of harms; 4. Not establish and validated measurements; 5. Clinical significant difference not prespecified; 6. Clinical significant difference not supported; 7. Other.
[e] Follow-Up key: 1. Not sufficient duration for benefit; 2. Not sufficient duration for harms; 3. Other.

Table 4. Study Design and Conduct Limitations of the LAPDOG Trial

Study	Allocation[a]	Blinding[b]	Selective Reporting[c]	Data Completeness[d]	Power[e]	Statistical[f]
Haines et al. (2002) (2)		1, 2. Blinding did not appear to occur		1. Of 34 initially randomized patients, 9 were lost to follow-up, 6 month follow-up data was obtained on only 27 patients, and 12 month follow-up data was obtained for only 19 patients	3. Power estimates led the investigators to plan enrollment of 330 patients in order to reliably identify a difference in success rate of 15% or greater; results were analyzed on 27 patients	1. Beyond the cursory discussion of lack of power, a discussion of the statistical analyses is nonexistent

The study limitations stated in this table are those notable in the current literature review; this is not a comprehensive gaps assessment.
[a] Allocation key: 1. Participants not randomly allocated; 2. Allocation not concealed; 3. Allocation concealment unclear; 4. Inadequate control for selection bias.
[b] Blinding key: 1. Not blinded to treatment assignment; 2. Not blinded outcome assessment; 3. Outcome assessed by treating physician.
[c] Selective Reporting key: 1. Not registered; 2. Evidence of selective reporting; 3. Evidence of selective publication.
[d] Data Completeness key: 1. High loss to follow-up or missing data; 2. Inadequate handling of missing data; 3. High number of crossovers; 4. Inadequate handling of crossovers; 5. Inappropriate exclusions; 6. Not intent to treat analysis (per protocol for noninferiority trials).
[e] Power key: 1. Power calculations not reported; 2. Power not calculated for primary outcome; 3. Power not based on clinically important difference.
[f] Statistical key: 1. Analysis is not appropriate for outcome type: (a) continuous; (b) binary; (c) time to event; 2. Analysis is not appropriate for multiple observations per patient; 3. Confidence intervals and/or p values not reported; 4. Comparative treatment effects not calculated.

All published trials have focused on lumbar disc herniation. There were no RCTs of automated percutaneous discectomy for cervical or thoracic disc herniation. A review of the evidence from the American Society of Interventional Pain Physicians (ASIPP) (2013) noted that “even though

Dekompressor [disc removal system] may be considered a new interventional modality, the early studies were published approximately 8 years ago. Consequently, one would expect that the technique's continued use would be supported by more recent, high-quality evaluations." (3)

Section Summary: Automated Percutaneous Discectomy

The evidence for automated percutaneous discectomy in individuals who have herniated intervertebral disc(s) includes small RCTs and systematic reviews. Evidence from small RCTs does not support the use of this procedure. Well-designed and executed RCTs are needed to determine the benefits and risks of this procedure.

Percutaneous Endoscopic Discectomy

Clinical Context and Therapy Purpose

The purpose of percutaneous endoscopic discectomy is to provide a treatment option that is an alternative to or an improvement on existing therapies for individuals with herniated intervertebral disc(s).

The following PICO was used to select literature to inform this policy.

Populations

The relevant population of interest is individuals with herniated intervertebral disc(s).

Interventions

The therapy being considered is percutaneous endoscopic discectomy.

Comparators

The following therapies and practices are currently being used to treat herniated intervertebral disc(s): conservative therapy and open discectomy or microdiscectomy.

Outcomes

The general outcomes of interest are symptoms, functional outcomes, quality of life, and treatment-related morbidity. Specific outcomes measured by specific instruments include improvements in functional outcomes assessed on the ODI, reductions in pain using a VAS, improvements in quality of life measured on the SF-36 and Euro-QOL-5D, and treatment-related morbidity including surgical success/failure and complications. To assess outcomes, follow-up at 1 year is considered appropriate.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs.
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.

- To assess longer term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.
- Studies with duplicative or overlapping populations were excluded.

Systematic Reviews

A number of systematic reviews have evaluated the efficacy and safety of percutaneous endoscopic discectomy compared to open discectomy or microendoscopic discectomy. A comparison of the trials included in more recent systematic reviews (2017 to present) is shown in Table 5. Characteristics and results of these reviews are summarized in Tables 6 and 7A/B.

Table 5. Trials Included in Systematic Reviews of Percutaneous Endoscopic Discectomy Versus Other Discectomy Procedures

Trials	**Systematic Reviews**							
	Phan et al. (2017) (4)	Shi et al. (2019) (5)	Yu et al. (2019) (6)	Zhou et al. (2020) (7)	Xu et al. (2020) (8)	Bao et al. (2021) (9)	Gadjradj et al. (2021) (10)	Zhao et al. (2022) (11)
Ma et al. (2022) (12)								●
Wang et al. (2021) (13)								●
Rajamani et al. (2021) (14)								●
Jing et al. (2021) (15)								●
Jarebi et al. (2021) (16)								●
Meyer et al. (2020) (17)								●
Chen et al. (2020) (18)								●
Kim et al. (2019) (19)								●
Ahn et al. (2019) (20)								●
Liu et al. (2018) (21)								●
Sun et al. (2017) (22)								●

Jeong et al. (2006) (23)								●
Akcakaya et al. (2016) (24)							●	
Choi et al. (2018) (25)							●	
Dai et al. (2020) (26)							●	
Krappel et al. (2001) (27)							●	
Tacconi et al. (2019) (28)							●	
Tacconi et al. (2020) (29)							●	
Tao et al. (2018) (30)							●	
Wang et al. (2017) (31)							●	
Xu et al. (2020) (32)							●	
Ahn et al. (2016) (33)						●		●
Chang et al. (2018) (34)						●	●	●
Liu et al. (2017) (35)						●		●
Pan et al. (2016) (36)						●	●	●
Yao et al. (2017) (37)						●		
Yao et al. (2017) (38)						●		●
Gibson et al. (2017) (39)				●			●	●

Hsu et al. (2013) (40)				●				
Kim et al. (2007) (41)				●		●		●
Qu et al. (2017) (42)				●				●
Wang et al. (2013) (43)				●				●
Zhao et al. (2012) (44)				●				
Yoon et al. (2012) (45)	●	●	●		●			
Li et al. (2015) (46)	●				●			●
Sinkemani et al. (2015) (47)	●	●	●		●			●
Song et al. (2017) (48)		●	●		●			●
Tu et al. (2017) (49)					●			
Liu et al. (2018) (21)		●	●	●	●	●		
Li et al. (2018) (50)		●	●	●	●			●
Abdurexiti et al. (2018) (51)		●	●		●			
Chen et al. (2018) (52)		●	●	●	●	●		●
Liu et al. (2012) (53)			●					
Wu et al. (2009) (54)		●						
Yang et al. (2015) (55)		●		●				
Duan et al. (2016) (56)		●						
Zhao et al. (2016) (57)		●						
Ding et al. (2017) (58)		●						●

Li et al. (2017) (59)		●						
Liu et al. (2017) (60)		●						
Luo et al. (2017) (61)		●						
Qu et al. (2017) (62)		●						
Chen et al. (2018) (63)		●						
Wu et al. (2018) (64)		●						
Belykh et al. (2016) (65)		●						
Chen et al. (2015) (66)	●							●
Choi et al. (2016) (67)	●			●				●
Garg et al. (2011) (68)	●							
Hermantin et al. (1999) (69)	●						●	
Huang et al. (2005) (70)	●							
Hussein et al. (2014) (71)	●							
Kleinpeter et al. (1995) (72)	●							
Lee et al. (2009) (73)	●					●		●
Martin-Laez et al. (2012) (74)	●							
Mayer et al. (1993) (75)	●			●		●	●	●
Ohya et al. (2016) (76)	●							

Pan et al. (2014) (77)	●							●
Righesso et al. (2007) (78)	●							
Ruetten et al. (2008) (79)	●							
Ruetten et al. (2009) (80)	●					●		
Sasaoka et al. (2006) (81)	●							
Schizas et al. (2005) (82)	●							
Teli et al. (2010) (83)	●							
Ruetten et al. (2007) (84)	●							
Ruetten et al. (2008) (85)						●		
Lee et al. (2006) (86)						●		

Table 6. Summary of Systematic Reviews of Percutaneous Endoscopic Discectomy Versus Other Discectomy Procedures

Study	Dates	Trials	Participants	N (Range)	Design	Duration
Zhao et al. (2022) (11)	To May 2022	33	Patients with lumbar disc herniation who underwent PTED, MED or other surgical procedures	6467 (20-1856)	7 RCTs; 26 non-randomized controlled retrospective studies	Not reported
Bai et al. (2021) (9)	To February 2018	14	Patients with lumbar disc herniation who underwent PELD or	2528 (74-902)	4 RCTs; 10 cohort studies	Not reported

			other surgical procedures			
Gadjradj et al. (2021) (10)	To April 2020	14	Patients with lumbar disc herniation who underwent PTED or open microdiscectomy	1465 (30-462)	9 RCTs; 5 prospective nonrandomized comparative studies	Follow-up: 3 to 12 months
Xu et al. (2020) (8)	Search dates not stated; included trials from 2012 to 2018	9	Patients with single-level lumbar disc herniation who underwent PELD or MED for treatment	984 (51-216)	1 Prospective RCTs; 8 Retrospective nonrandomized comparative studies	Follow-up: 1 to > 6 years
Zhou et al. (2020) (7)	To October 2018	12	Patients with lumbar disc herniation who underwent PELD or MED for treatment	2400 (40-915)	4 RCTs; 8 Retrospective nonrandomized comparative studies	Follow-up: 3 to 46 months
Yu et al. (2019) (6)	To August 31, 2018	8	Patients with lumbar disc herniation who underwent PTED or MED procedures and were followed for at least 6 months	805 (51-216)	1 Prospective RCTs; 7 Observational studies	Follow-up: 6 months to 5 years
Shi et al. (2019) (5)	To July 2018	18	Patients with single-level lumbar disc herniation with sciatica who underwent PELD or MED for treatment	2161 (51-273)	8 Prospective studies; 10 Retrospective studies	Follow-up: 3 months to >6 years
Phan et al. (2017) (4)	To February 2016	23	Patients who underwent either an endoscopic or open approach for disc herniation; the endoscopic approach consisted of patients who	24,487 (20-26,612)	10 Prospective RCTs; 4 Prospective observational studies; 9 Retrospective observational studies	Follow-up: 3 to 104 months

			underwent either FED or MED while the open approach included those who underwent open discectomy or micro-discectomy			

FED: full-endoscopic technique discectomy; MED: microendoscopic discectomy; PELD: percutaneous endoscopic lumbar discectomy; PTED: percutaneous transforaminal endoscopic discectomy; RCT: randomized controlled trial

Table 7A. Results of Systematic Reviews of Trials of Percutaneous Endoscopic Discectomy Versus Other Discectomy Procedures

Study	Length of stay	Leg pain VAS	Lower back pain VAS
Zhao et al. (2022) (11)			
Total (N)	1231	1487	1372
Pooled effect (95% CI); p value	MD -2.42 (-3.21 to -1.63); .0001	MD -0.23(-0.61 to 0.15); .60	MD -0.49 (-0.84 to -0.14); .006
I^2 (p)	95%; .00001	51%; .03	90%; .00001
Bai et al. (2021) (9)			
Total (N)	NR	NR	NR
Pooled effect (95% CI); p value	MD -2.59 (-3.87 to -1.31); <.001	MD 0.00 (-0.10 to 0.10);.991	MD -0.17 (-0.55 to 0.21); .384
I^2 (p)	72.1%; .001	0.0%; .996	88.3%; <.001
Gadjradj et al. (2021) (10)			
Total (N)		621 and 152	
Pooled effect (95% CI); p value		3 to 6 month MD 0.05 (-0.10 to 0.21) 12 month MD 0.11 (-0.30 to 0.53)	
I^2 (p)		30%; .23	
Xu et al. (2020) (8)			
Total (N)	NR	NR	NR
Pooled effect (95% CI); p value	OR -1.041 (-1.493 to -0.583); .000	6 months to 2 years OR -0.138 (-0.384 to 0.108); .270 2 years OR 0.020 (-0.193 to 0.233); .855	6 months to 2 years -0.456 (-0.947 to 0.034); .068 2 years OR -0.856 (-1.488 to -0.224); .008
I^2 (p)		53.8%; .090; 6 months to 2 years 4.4%; .351; 2 years	88%; .000; 6 months to 2 years 86.7%; .001; 2 years
Zhou et al. (2020) (7)			

Total (N)			
Pooled effect (95% CI); p value			
I^2 (p)			
Yu et al. (2019) (6)			
Total (N)	707	NR	NR
Pooled effect (95% CI); p value	MD -1.92 (-2.90 to -0.94); <.001	1 year postop or last follow-up: MD -0.07 (-0.22 to 0.08); .38	1 year postop or last follow-up: MD -0.41 (-0.76 to -0.06); .02
I^2 (p)	88%		
Shi et al. (2019) (5)			
Total (N)	1717	742	742
Pooled effect (95% CI); p value	MD -2.29 (3.03 to -1.55); <.00001	At last follow-up: MD -0.18 (-0.45 to 0.09); .19	At last follow-up: MD -0.77 (-1.31 to -0.24); .005
I^2 (p)	96%; <.00001	88%; <.00001	95%; <.00001
Phan et al. (2017) (4)			
Total (N)	685	390	
Pooled effect (95% CI); p value	MD -4.79 (-6.52 to -3.07); <.00001	MD -0.04 (-0.37 to 0.30); .84	
I^2 (p)	99%; <.00001	70%; .003	

CI: confidence interval; MD: mean difference; NR: not reported; ODI: Oswestry Disability Index; OR: odds ratio; RR: risk ratio; VAS: visual analogue scale; WMD: weighted mean difference

Table 7B. Results of Systematic Reviews of Trials of Percutaneous Endoscopic Discectomy Versus Other Discectomy Procedures

Study	ODI	Overall complication rate	Reoperation	Recurrence or residue
Zhao et al. (2022) (11)				
Total (N)	1687	2,372	2,226	2,621
Pooled effect (95% CI); p value	MD -2.21 (-4.17 to -0.25); .03	OR 0.94 (0.67 to 1.32); .71	OR 1.67 (1.17 to 2.36); .004	OR 1.55 (1.07 to 2.24); .02
I^2 (p)	88%; .00001	0%; .65	0%; .89	0%; .93
Bai et al. (2021) (9)				
Total (N)	NR	NR		NR
Pooled effect (95% CI); p value	MD -0.29 (-1.00 to 0.43); .434	relative risk 0.86 (0.63 to 1.18); .361		relative risk 1.65 (1.08 to 2.52); .021
I^2 (p)	0.0%; .996	51.5%; .024		26.1%; .220
Gadjradj et al. (2021) (10)				
Total (N)	621 and 152			

Pooled effect (95% CI); p value	3-to-6-month MD -0.09 (-0.24 to 0.07) 12-month MD -0.11 (-0.45 to 0.24)			
I^2 (p)	9%; .83			
Xu et al. (2020) (8)				
Total (N)	NR	NR	NR	NR
Pooled effect (95% CI); p value	6 months to 2 years -0.077 (-0.370 to 0.215); .604 2 years OR -0.425 (-0.724 to -0.127); .005	OR 0.972 (0.635 to 1.488); .896	OR 1.136 (0.415 to 3.108); .805	OR 1.306 (0.664 to 2.566); .439
I^2 (p)	75.3%; .000; 6 months to 2 years 52.7%; .121; 2 years			
Zhou et al. (2020) (7)				
Total (N)			787	972
Pooled effect (95% CI); p value			OR 1.77 (1.18 to 2.64); .006	OR 1.60 (1.01 to 2.53); .05
I^2 (p)			0%; .97	0%; .94
Yu et al. (2019) (6)				
Total (N)	NR	659		443
Pooled effect (95% CI); p value	1 year postop or last follow-up: MD -0.27 (-1.71 to 1.16); .71	MD 1.01 (0.60 to 1.69); .98		MD 1.31 (0.54 to 3.17); .54
I^2 (p)		0%		0%
Shi et al. (2019) (5)				
Total (N)	1337	1527	805	928
Pooled effect (95% CI); p value	At last follow-up: MD -0.30 (-1.02 to 0.42); .41	OR 0.96 (0.65 to 1.43); .85	OR 2.67 (1.07 to 6.67); .04	OR 2.22 (1.02 to 4.83); .05
I^2 (p)	55%; .01	0%; .90	0%; .79	0%; .86
Phan et al. (2017) (4)				
Total (N)	303	27,699	995	1081

Pooled effect (95% CI); p value	MD -1.88 (-4.06 to 0.29); .09	OR 0.77 (0.45 to 1.31); .33	OR 1.46 (0.33 to 6.43); .61	OR 1.12 (0.60 to 2.09); .73
I^2 (p)	67%; .03	60%; .004	66%; .004	0%; .97

CI: confidence interval; MD: mean difference; NR: not reported; ODI: Oswestry Disability Index; OR: odds ratio; RR: risk ratio; VAS: visual analogue scale; WMD: weighted mean difference.

Results from the systematic reviews were fairly consistent with a significantly reduced length of hospitalization observed with endoscopic discectomy and sometimes significant improvements in VAS or ODI, but only at specific time points. Overall, no consistently significant improvement in VAS, ODI, total complication rate, reoperation, or recurrence was observed with endoscopic discectomy versus other interventions. Authors of the systematic reviews noted multiple limitations including the innate flaws of included studies (i.e., observational designs, a limited number of studies meeting criteria for inclusion, small sample sizes, lack of allocation concealment and blinding), different methodologies contributing to heterogeneity in analyses, loss of usable and sufficient data resulting in difficulty performing accurate analysis of outcomes, and that a majority of the more recently completed studies were completed in China, which may affect the generalizability of the results to other populations.

Randomized Controlled Trials

More recent RCTs not included in any of the systematic reviews were also identified. (87-90) Results of these trials were similar to those seen in the more comprehensive systematic reviews - percutaneous endoscopic discectomy was associated with a significant reduction in length of stay with no consistent improvement in patient-reported outcome measures such as VAS and ODI. Two of the 4 RCTs evaluated treatment-related morbidities, and reported a reduced incidence of intraoperative and postoperative complications and repeat surgeries with percutaneous endoscopic discectomy. Key characteristics, results, and limitations of these RCTs are summarized in the following tables.

Table 8. Characteristics of RCTs of Percutaneous Endoscopic Discectomy

Study	Countries	Sites	Dates	Participants	Interventions
Liu et al. (2023) (90)	Korea	1	July 2016 to July 2021	Patients with L5-S1 lumbar disc herniation	Interlaminar endoscopic lumbar discectomy vs microscopic lumbar discectomy
Gadjradj et al. (2022) (87)	Netherlands	4	February 2016 to April 2019	Patients with sciatica caused by lumbar disc herniation	PTED vs microendoscopic discectomy
Ran et al. (2021) (88)	China	1	August 2016 to February 2020	Patients with highly migrated lumbar disc herniation	PELD with computerized tomography

					navigation vs open discectomy
Wang et al. (2019) (89)	China	1	July 2015 to July 2016	Patients with single-segment lumbar disc herniation with imaging results consistent with symptoms	PTED vs microendoscopic discectomy

PELD: percutaneous endoscopic lumbar discectomy; PTED: percutaneous transforaminal endoscopic discectomy; RCT: randomized controlled trials.

Table 9A. Results of RCTs of Percutaneous Endoscopic Discectomy

Study	Length or stay (days)	Leg pain VAS	Lower back pain VAS	ODI
Liu et al. (2023) (90)				
N	28	28		
Mean difference at 12 months (95% CI)		0.71 (-2.54 to 1.12)	0.08 (-2.25 to 2.42)	8.48 (-1.67 to 18.63)
Interlaminar endoscopic lumbar discectomy	3.69±1.60 days			
Microscopic lumbar discectomy	5.47±1.36 days			
p-value	.003			
Gadjradj et al. (2022) (87)				
N	420	413	413	413
Pooled effect at 12 months (95% CI)	Median (IQR) PTED: 0 (0 to 0) Microendoscopic discectomy: 1 (1 to 1)	MD 7.1 (2.8 to 11.3)	MD 6 (2 to 10)	MD 5.3 (3.0 to 7.7)
p-value				
Ran et al. (2021) (88)				
N		66		
PELD with computerized tomography navigation at 12 months		0.58 ± 0.90		

Open discectomy at 12 months		0.75 ± 0.84		
p-value		.58		
Wang et al. (2019) (89)				
N	90	90	90	90
Percutaneous transforaminal endoscopic discectomy	Postoperative: 3.01 ± 0.52	Preoperative mean score vs. 6 months after surgery: 7.21 vs. 1.05	Preoperative mean score vs 6 months after surgery: 6.40 vs. 1.36	Preoperative mean score vs 6 months after surgery: 58.21% vs. 17.05%
Microendoscopic discectomy	Postoperative: 6.68 ± 0.30	Preoperative mean score vs. 6 months after surgery: 7.09 vs. 0.98	Preoperative mean score vs 6 months after surgery: 6.34 vs. 1.65	Preoperative mean score vs 6 months after surgery: 57.17% vs. 16.98%
p	.001	.097	.523	.864

CI: confidence interval; IQR: interquartile range; MD: mean difference; ODI: Oswestry Disability Index; PELD: percutaneous endoscopic lumbar discectomy; PTED: percutaneous transforaminal endoscopic discectomy; RCT: randomized controlled trials; VAS: visual analogue scale.

Table 9B. Results of RCTs of Percutaneous Endoscopic Discectomy

Study	SF-36 PCS	Complication rates	Repeat surgery within 1 year
Liu et al. (2023) (90)			
N		28	
Mean difference at 12 months (95% CI)			
Interlaminar endoscopic lumbar discectomy		Blood loss: 44±26.67 mL	
Microscopic lumbar discectomy		Blood loss: 20±20.99 mL	
p-value		.009	
Gadjradj et al. (2022) (87)			
N	413	420	420
Pooled effect at 12 months (95% CI)	MD -2.8 (-4.1 to -1.6)	PTED vs microendoscopic discectomy: Dural tears (n=0 vs 8)	PTED vs microendoscopic discectomy: n=9 (5%) vs 14 (6%)

		Nerve root injury (n=0 vs 1) Wound infection (n=3 vs 0) Cerebrospinal fluid leakage (n=1 vs 0)	
p-value			
Ran et al. (2021) (88)			
N		66	
PELD with computerized tomography navigation at 12 months		Infection, n=0 Recurrence, n=1	
Open discectomy at 12 months		Infection, n=1 Recurrence, n=0	
p-value		>.99	
Wang et al. (2019) (89)			
N			
Percutaneous transforaminal endoscopic discectomy			
Micro-endoscopic discectomy			
p			

CI: confidence interval; MD: mean difference; PELD: percutaneous endoscopic lumbar discectomy; PTED: percutaneous transforaminal endoscopic discectomy; RCT: randomized controlled trials; SF-36 PCS: Short-Form-36 Physical Component Score.

Table 10. Study Relevance Limitations of the RCTS of Percutaneous Endoscopic Discectomy

Study	Population[a]	Intervention[b]	Comparator[c]	Outcomes[d]	Duration of Follow-up[e]
Liu et al. (2023) (90)	4. Limited to participants from single site in Korea			1. Morbidity-related outcomes such as complications and reoperation were limited	

Gadjradj et al. (2022) (87)	4. Limited to participants from 3 sites in the Netherlands				
Ran et al. (2021) (88)	4. Limited to participants from single site in China	4. PELD was used with computerized tomography navigation		1. Morbidity-related outcomes such as complications were limited	
Wang et al. (2019) (89)	4. Study population similar to other trials with regard to age, sex; however, included patients from a single Chinese hospital			1. Morbidity-related outcomes such as complication and reoperation rates were not reported	1,2. Outcomes reported only for 6 months of follow-up

PELD: percutaneous endoscopic lumbar discectomy; RCT: randomized controlled trials.
The study limitations stated in this table are those notable in the current literature review; this is not a comprehensive gaps assessment; 4. Enrolled populations do not reflect relevant diversity; 5. Other.
[a] Population key: 1. Intended use population unclear; 2. Study population is unclear; 3. Study population not representative of intended use.
[b] Intervention key: 1. Not clearly defined; 2. Version used unclear; 3. Delivery not similar intensity as comparator; 4. Not the intervention of interest.
[c] Comparator key: 1. Not clearly defined; 2. Not standard or optimal; 3. Delivery not similar intensity as intervention; 4. Not delivered effectively.
[d] Outcomes key: 1. Key health outcomes not addressed; 2. Physiologic measures, not validated surrogates; 3. No CONSORT reporting of harms; 4. Not established and validated measurements; 5. Clinically significant difference not prespecified; 6. Clinically significant difference not supported.
[e] Follow-Up key: 1. Not sufficient duration for benefit; 2. Not sufficient duration for harms.

Table 11. Study Design and Conduct Limitations of the RCTs of Percutaneous Endoscopic Discectomy

Study	Allocation[a]	Blinding[b]	Selective Reporting[c]	Data Completeness[d]	Power[e]	Statistical[f]
Liu et al. (2023) (90)		1,2. Blinding did not occur			1. No mention of power	

Gadjradj et al. (2022) (87)	4. A proportion of patients with a strong preference for PTED who were randomised to open microdiscectomy dropped out of the study after randomization	1,2. Blinding did not occur				
Ran et al. (2021) (88)	3. Allocation concealment unclear	1,2. Blinding did not occur			1. Power calculations not reported	
Wang et al. (2019) (89)	3. Allocation concealment unclear	1,2. Blinding did not appear to occur			1. Power calculations not reported	

PTED: percutaneous transforaminal endoscopic discectomy; RCT: randomized controlled trials.
The study limitations stated in this table are those notable in the current literature review; this is not a comprehensive gaps assessment.
[a] Allocation key: 1. Participants not randomly allocated; 2. Allocation not concealed; 3. Allocation concealment unclear; 4. Inadequate control for selection bias.
[b] Blinding key: 1. Not blinded to treatment assignment; 2. Not blinded outcome assessment; 3. Outcome assessed by treating physician.
[c] Selective Reporting key: 1. Not registered; 2. Evidence of selective reporting; 3. Evidence of selective publication.
[d] Data Completeness key: 1. High loss to follow-up or missing data; 2. Inadequate handling of missing data; 3. High number of crossovers; 4. Inadequate handling of crossovers; 5. Inappropriate exclusions; 6. Not intent to treat analysis (per protocol for noninferiority trials).
[e] Power key: 1. Power calculations not reported; 2. Power not calculated for primary outcome; 3. Power not based on clinically important difference.
[f] Statistical key: 1. Analysis is not appropriate for outcome type: (a) continuous; (b) binary; (c) time to event; 2. Analysis is not appropriate for multiple observations per patient; 3. Confidence intervals and/or p values not reported; 4. Comparative treatment effects not calculated.

Observational Studies

Comparative observational studies with at least a 2-year follow-up are summarized below.

Yang et al. (2024) published the results of a retrospective study that compared transforaminal endoscopic lumbar discectomy (n=89) to microdiscectomy (n=65) in patients with lumbar disc herniation. (91) The mean follow-up was 5.5 years. Postsurgical VAS scores of the leg and back reached their lowest point at 1 year and were maintained until the final follow-up. Oswestry

Disability Index scores continued to decrease until final follow-up in patients who underwent transforaminal endoscopic lumbar discectomy but remained fairly similar between 1 year and final follow-up among patients who underwent microdiscectomy. Recurrence occurred in 4.49% and 1.54% (p=.31) of patients in the transforaminal endoscopic lumbar discectomy and microdiscectomy groups, respectively.

Saghebdoust et al. (2023) published the results of a retrospective study in 434 patients with lumbar disc herniation who underwent transforaminal endoscopic lumbar discectomy or open microdiscectomy. (92) At the end of the 7-year follow-up period, records for 412 patients were evaluable. A similar proportion of patients in both groups had outcomes that were rated as excellent or good (about 88%) according to the modified MacNab criteria. Perioperative complications were similar between groups, but intraoperative blood loss (p<.05) and length of hospital stay (p<.05) were significantly less in the transforaminal endoscopic lumbar discectomy group. Recurrence that required reoperation occurred in 21 patients in the transforaminal endoscopic lumbar discectomy group and 9 patients in the open microdiscectomy group (p<.05).

Yu et al. (2021) published the results of a retrospective multicenter study that followed patients for 2 years after receipt of transforaminal percutaneous endoscopic discectomy (n=632) and microendoscopic discectomy (n=421) for lumbar disc herniation. (6) Mean blood loss (p<.001) and mean duration of hospital stay (p=.018) were significantly reduced with transforaminal percutaneous endoscopic lumbar discectomy compared to microendoscopic discectomy. Rates of complications, recurrence, and revisions were similar in both groups. The VAS pain scores did not differ between groups after the first postoperative day. At 1 month postoperatively, there was a significant difference in ODI scores between groups (p=.016) in favor of transforaminal percutaneous endoscopic discectomy, but there was no significant difference at other time points.

Song et al. (2021) published a retrospective single-center study that compared percutaneous endoscopic lumbar discectomy (n=306) and microendoscopic discectomy (n=116) in patients undergoing same day ambulatory surgery for lumbar disc herniation. (48) Mean blood loss and mean duration of hospital stay were significantly less with percutaneous endoscopic lumbar discectomy (both p<.001 compared to microendoscopic discectomy). After 3 years of follow-up, VAS pain scores for the back were also significantly lower in the percutaneous endoscopic lumbar discectomy group compared to the microendoscopic discectomy group (p=.001) but there was no difference between groups in pain scores for the legs (p=.224). Overall recurrence rates (p=.201) and ODI scores (p=.220) were also similar between groups.

A number of observational studies have also assessed the learning curve (93-95) and the need for longer follow-up for endoscopic discectomy. (96, 97) The largest and longest follow-up to date has been reported by Choi et al. (2015), who examined 10,228 patients at their institution who had had percutaneous endoscopic lumbar discectomy over a 12-year period. (98) They found that 4.3% of cases required reoperation in the first 6 weeks due to incomplete removal of

herniated discs (2.8%), recurrence (0.8%), persistent pain (0.4%), and approach-related pain (0.2%).

Section Summary: Percutaneous Endoscopic Discectomy

The evidence for percutaneous endoscopic discectomy in individuals who have herniated intervertebral disc(s) includes a number of RCTs, systematic reviews, and comparative observational studies with at least 2 years of follow-up. Many of the more recent RCTs were conducted at institutions within China. There are few reports from the United States. Overall, results from RCTs and systematic reviews reveal a significantly reduced length of hospitalization with endoscopic discectomy and occasionally significant improvements in VAS or ODI, but only at specific time points. No consistently significant improvement in VAS, ODI, total complication rate, reoperation, or recurrence was observed with percutaneous endoscopic discectomy versus other interventions.

Summary of Evidence

For individuals who have herniated intervertebral disc(s) who receive automated percutaneous discectomy, the evidence includes randomized controlled trials (RCTs) and systematic reviews of observational studies. Relevant outcomes are symptoms, functional outcomes, quality of life, and treatment-related morbidity. The published evidence from small RCTs is insufficient to evaluate the impact of automated percutaneous discectomy on the net health outcome. Well-designed and executed RCTs are needed to determine the benefits and risks of this procedure. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have herniated intervertebral disc(s) who receive percutaneous endoscopic discectomy, the evidence includes a number of RCTs, systematic reviews, and observational studies. Relevant outcomes are symptoms, functional outcomes, quality of life, and treatment-related morbidity. Many of the more recent RCTs were conducted at institutions within China. There are few reports from the United States. Results do not reveal a consistently significant improvement in patient-reported outcomes and treatment-related morbidity with percutaneous endoscopic discectomy in comparison to other discectomy interventions. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Practice Guidelines and Position Statements

National Institute for Health and Care Excellence

The National Institute for Health and Care Excellence (NICE; 2005) published guidance on automated percutaneous mechanical lumbar discectomy, indicating that there was limited evidence of efficacy based on uncontrolled case series of heterogeneous groups of patients, and evidence from small RCTs showed conflicting results. (99) The guidance indicated that, in view of uncertainty about the efficacy of the procedure, it should not be done without special arrangements for consent and for audit or research. The guidance was considered for an update in 2009, but failed review criteria; the 2005 guidance is therefore considered current.

A NICE (2016) guidance on percutaneous transforaminal endoscopic lumbar discectomy for sciatica was published. (100) The guidance stated that current evidence is adequate to support the use of percutaneous transforaminal endoscopic lumbar discectomy for sciatica. Choice of operative procedure (open discectomy, microdiscectomy, or percutaneous endoscopic approaches) may be influenced by symptoms, and location and size of prolapsed disc.

A NICE (2016) guidance on percutaneous interlaminar endoscopic lumbar discectomy for sciatica was also published. (101) The guidance stated that current evidence is adequate to support the use of percutaneous interlaminar endoscopic lumbar discectomy for sciatica. Choice of operative procedure (open discectomy, microdiscectomy, or percutaneous endoscopic approaches) may be influenced by symptoms, location, and size of the prolapsed disc.

American Society of Interventional Pain Physicians

The guidelines from the American Society of Interventional Pain Physicians (2013) indicated that the evidence for percutaneous disc decompression with the Dekompressor was limited. (3) There were no recommended indications for the Dekompressor.

North American Spine Society

The North American Spine Society (NASS) (2014) published clinical guidelines on the diagnosis and treatment of lumbar disc herniation. (102) Table 12 summarizes recommendations specific to percutaneous endoscopic discectomy and automated percutaneous discectomy.

Table 12. Recommendations for Lumbar Disc Herniation With Radiculopathy

Recommendations	Grade or LOE[a]
Endoscopic percutaneous discectomy is suggested for carefully selected patients to reduce early postoperative disability and reduce opioid use compared with open discectomy	B
There is insufficient evidence to make a recommendation for or against the use of automated percutaneous discectomy compared with open discectomy	I
Endoscopic percutaneous discectomy may be considered for treatment.	C
Automated percutaneous discectomy may be considered for treatment.	C
Patients undergoing percutaneous endoscopic discectomy experience better outcomes if <40 years and symptom duration <3 months.	II

LOE: level of evidence

[a] Grade B: fair evidence (level II or III studies with consistent findings; Grade C: poor quality evidence (level IV or V studies). Level of evidence II: lesser quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization), prospective comparative study, systematic review of level II studies or level I studies with inconsistent results; level of evidence III: case control, retrospective, systematic review of level III studies; level of evidence IV: case series; level of evidence V: expert opinion.

American Pain Society

The clinical practice guidelines from the American Pain Society (2009) found insufficient evidence to evaluate alternative surgical methods to standard open discectomy and microdiscectomy, including laser or endoscopic-assisted techniques, various percutaneous techniques, coblation nucleoplasty, or the Dekompressor. (103)

American Society of Pain and Neuroscience

The American Society of Pain and Neuroscience (ASPN; 2022) published clinical guidance for interventional treatments for low back pain. (104) The guideline states that discectomy procedures (such as percutaneous and endoscopic disc procedures) have favorable safety and efficacy profiles for the treatment of lumbar disc herniation with persistent radicular symptoms; however, it is stated that further research is needed to evaluate complications rates in order for these procedures to supplant classic open microdiscectomy. Recommendations specific to percutaneous endoscopic discectomy are summarized in Table 13.

Table 13. Recommendations for Percutaneous and Endoscopic Procedures

Recommendation	Grade[a]	Level of Evidence[b]	Level of Certainty [Net Benefit][c]
Percutaneous Endoscopic Discectomy	B	I-a	High

[a] Grade B: (The ASPN Back Group recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.
[b] Evidence Level: I-A: At least one controlled and randomized clinical trial, properly designed.

Ongoing and Unpublished Clinical Trials

Currently unpublished trials that might influence this policy are listed in Table 14.

Table 14. Summary of Key Trials

NCT Number	Trial Name	Planned Enrollment	Completion Date
Unpublished			
NCT02602093	Percutaneous Transforaminal Endoscopic Discectomy vs. Open Microdiscectomy for Lumbar Disc Herniation (PTED-study)	682	May 2024 (unknown status)
NCT01997086	Percutaneous Transforaminal Endoscopic Discectomy (PTED) vs. Microendoscopic Discectomy (MED) for the treatment of Lumbar Disc Herniation: A Prospective Randomized Controlled Study	125	Aug 2023 (unknown status)
NCT02742311	EuroPainClinics® Study V Prospective Observational Study (EPCSV)	500	Dec 2021 (completed)

NCT: national clinical trial.

Coding

Procedure codes on Medical Policy documents are included **only** as a general reference tool for each policy. **They may not be all-inclusive.**

The presence or absence of procedure, service, supply, or device codes in a Medical Policy document has no relevance for determination of benefit coverage for members or reimbursement for providers. **Only the written coverage position in a Medical Policy should be used for such determinations.**

Benefit coverage determinations based on written Medical Policy coverage positions must include review of the member's benefit contract or Summary Plan Description (SPD) for defined coverage vs. non-coverage, benefit exclusions, and benefit limitations such as dollar or duration caps.

CPT Codes	62287, 62380
HCPCS Codes	C2614

*Current Procedural Terminology (CPT®) ©2024 American Medical Association: Chicago, IL.

References

1. Lewis RA, Williams NH, Sutton AJ, et al. Comparative clinical effectiveness of management strategies for sciatica: systematic review and network meta-analyses. Spine J. Jun 1 2015; 15(6):1461-1477. PMID 24412033
2. Haines SJ, Jordan N, Boen JR, et al. Discectomy strategies for lumbar disc herniation: results of the LAPDOG trial. J Clin Neurosci. Jul 2002; 9(4):411-417. PMID 12217670
3. Manchikanti L, Abdi S, Atluri S, et al. An update of comprehensive evidence-based guidelines for interventional techniques in chronic spinal pain. Part II: guidance and recommendations. Pain Physician. Apr 2013; 16(2 Suppl):S49-283. PMID 23615883
4. Phan K, Xu J, Schultz K, et al. Full-endoscopic versus micro-endoscopic and open discectomy: A systematic review and meta-analysis of outcomes and complications. Clin Neurol Neurosurg. Mar 2017; 154:1-12. PMID 28086154
5. Shi R, Wang F, Hong X, et al. Comparison of percutaneous endoscopic lumbar discectomy versus microendoscopic discectomy for the treatment of lumbar disc herniation: a meta-analysis. Int Orthop. Apr 2019; 43(4):923-937. PMID 30547214
6. Yu P, Qiang H, Zhou J, et al. Percutaneous transforaminal endoscopic discectomy versus micro-endoscopic discectomy for lumbar disc herniation. Med Sci Monit. Mar 30 2019; 25:2320-2328. PMID 30927349
7. Zhao XM, Yuan QL, Liu L, et al. Is it possible to replace microendoscopic discectomy with percutaneous transforaminal discectomy for treatment of lumbar disc herniation? A meta-analysis based on recurrence and revision rate. J Korean Neurosurg Soc. Jul 2020; 63(4):477-486. PMID 32380585
8. Xu J, Li Y, Wang B, et al. Minimum 2-year efficacy of percutaneous endoscopic lumbar discectomy versus microendoscopic discectomy: A meta-analysis. World Neurosurg. Jun 2020; 138:19-26. PMID 32109644
9. Bai X, Lian Y, Wang J, et al. Percutaneous endoscopic lumbar discectomy compared with other surgeries for lumbar disc herniation: A meta-analysis. Medicine (Baltimore). Mar 05 2021; 100(9):e24747. PMID 33655938

10. Gadjradj PS, Harhangi BS, Amelink J, et al. Percutaneous transforaminal endoscopic discectomy versus open microdiscectomy for lumbar disc herniation: A systematic review and meta-analysis. Spine (Phila Pa 1976). Apr 15 2021; 46(8):538-549. PMID 33290374
11. Zhao XM, Chen AF, Lou XX, et al. Comparison of Three Common Intervertebral Disc Discectomies in the Treatment of Lumbar Disc Herniation: A Systematic Review and Meta-Analysis Based on Multiple Data. J Clin Med. Nov 08 2022; 11(22):6604. PMID 36431083
12. Ma C, Li H, Zhang T, et al. Comparison of Percutaneous Endoscopic Interlaminar Discectomy and Open Fenestration Discectomy for Single-Segment Huge Lumbar Disc Herniation: A Two-year Follow-up Retrospective Study. J Pain Res. 2022; 15:1061-1070. PMID 35444463
13. Wang SF, Hung SF, Tsai TT, et al. Better Functional Outcome and Pain Relief in the Far-Lateral-Outside-in Percutaneous Endoscopic Transforaminal Discectomy. J Pain Res. 2021; 14:3927-3934. PMID 35002312
14. Rajamani PA, Goparaju P, Kulkarni AG, et al. A 2-Year Outcomes and Complications of Various Techniques of Lumbar Discectomy: A Multicentric Retrospective Study. World Neurosurg. Dec 2021; 156:e319-e328. PMID 34555576
15. Jing Z, Li L, Song J. Percutaneous transforaminal endoscopic discectomy versus microendoscopic discectomy for upper lumbar disc herniation: a retrospective comparative study. Am J Transl Res. 2021; 13(4):3111-3119. PMID 34017479
16. Jarebi M, Awaf A, Lefranc M, et al. A matched comparison of outcomes between percutaneous endoscopic lumbar discectomy and open lumbar microdiscectomy for the treatment of lumbar disc herniation: a 2-year retrospective cohort study. Spine J. Jan 2021; 21(1):114-121. PMID 32683107
17. Meyer G, DA Rocha ID, Cristante AF, et al. Percutaneous Endoscopic Lumbar Discectomy Versus Microdiscectomy for the Treatment of Lumbar Disc Herniation: Pain, Disability, and Complication Rate-A Randomized Clinical Trial. Int J Spine Surg. Feb 2020; 14(1):72-78. PMID 32128306
18. Chen Z, Zhang L, Dong J, et al. Percutaneous Transforaminal Endoscopic Discectomy Versus Microendoscopic Discectomy for Lumbar Disc Herniation: Two-Year Results of a Randomized Controlled Trial. Spine (Phila Pa 1976). Apr 15 2020; 45(8):493-503. PMID 31703056
19. Kim CH, Chung CK, Choi Y, et al. The Long-term Reoperation Rate Following Surgery for Lumbar Herniated Intervertebral Disc Disease: A Nationwide Sample Cohort Study With a 10-year Follow-up. Spine (Phila Pa 1976). Oct 01 2019; 44(19):1382-1389. PMID 30973508
20. Ahn Y, Lee SG, Son S, et al. Transforaminal Endoscopic Lumbar Discectomy Versus Open Lumbar Microdiscectomy: A Comparative Cohort Study with a 5-Year Follow-Up. Pain Physician. May 2019; 22(3):295-304. PMID 31151337
21. Liu X, Yuan S, Tian Y, et al. Comparison of percutaneous endoscopic transforaminal discectomy, microendoscopic discectomy, and microdiscectomy for symptomatic lumbar disc herniation: minimum 2-year follow-up results. J Neurosurg Spine. Mar 2018; 28(3):317-325. PMID 29303471
22. Sun Y, Zhang W, Qie S, et al. Comprehensive comparing percutaneous endoscopic lumbar discectomy with posterior lumbar internal fixation for treatment of adjacent segment lumbar disc prolapse with stable retrolisthesis: A retrospective case-control study. Medicine (Baltimore). Jul 2017; 96(29):e7471. PMID 28723757

23. Jeong JS, Lee SH, Lee JS, et al. The Clinical Comparison between Open Surgery and Percutaneous Endoscopic Lumbar Discectomy in Extraforaminal Lumbar Disc Herniation. J Korean Neurosurg Soc. 2006; 39(6):413-418.
24. Akcakaya MO, Yorukoglu AG, Aydoseli A, et al. Serum creatine phosphokinase levels as an indicator of muscle injury following lumbar disc surgery: Comparison of fully endoscopic discectomy and microdiscectomy. Clin Neurol Neurosurg. Jun 2016; 145:74-78. PMID 27101087
25. Choi KC, Shim HK, Hwang JS, et al. Comparison of surgical invasiveness between microdiscectomy and 3 different endoscopic discectomy techniques for lumbar disc herniation. World Neurosurg. Aug 2018; 116:e750-e758. PMID 29787880
26. Dai HJ, Zhang X, Wang LT, et al. The effect of percutaneous transforaminal endoscopic discectomy (PTED) on serum inflammatory factors and pain in patients with lumbar disc herniation after surgery. Int J Clin Exp Med. 2020; 13:597603.
27. Krappel FA, Schmitz R, Bauer E, et al. Open or endoscopic nucleotomy? Orthopadische Praxis. 2001; 37:1649.
28. Tacconi L, Giordan E. Endoscopic transforaminal discectomy vs. far lateral discectomy for extraforaminal disc protrusions: our experience. NeuroQuantology. 2019; 17:1822.
29. Tacconi L, Signorelli F, Giordan E. Is full endoscopic lumbar discectomy less invasive than conventional surgery? A randomized MRI study. World Neurosurg. Jun 2020; 138:e867-e875. PMID 32251813
30. Tao XZ, Jing L, Li JH. Therapeutic effect of transforaminal endoscopic spine system in the treatment of prolapse of lumbar intervertebral disc. Eur Rev Med Pharmacol Sci. Jul 2018; 22(1 Suppl):103-110. PMID 30004561
31. Wang H, Song Y, Cai L. Effect of percutaneous transforaminal lumbar spine endoscopic discectomy on lumbar disc herniation and its influence on indexes of oxidative stress. Biomed Res. 2017; 28(21):9464-9469.
32. Xu G, Zhang C, Zhu K, et al. Endoscopic removal of nucleus pulposus of intervertebral disc on lumbar intervertebral disc protrusion and the influence on inflammatory factors and immune function. Exp Ther Med. Jan 2020; 19(1):301-307. PMID 31853303
33. Ahn SS, Kim SH, Kim DW, et al. Comparison of outcomes of percutaneous endoscopic lumbar discectomy and open lumbar microdiscectomy for young adults: A retrospective matched cohort study. World Neurosurg. Feb 2016; 86:250-258. PMID 26409086
34. Chang F, Zhang T, Gao G, et al. Therapeutic effect of percutaneous endoscopic lumbar discectomy on lumbar disc herniation and its effect on oxidative stress in patients with lumbar disc herniation. Exp Ther Med. Jan 2018; 15(1):295-299. PMID 29250152
35. Liu C, Zhou Y. Percutaneous endoscopic lumbar diskectomy and minimally invasive transforaminal lumbar interbody fusion for recurrent lumbar disk herniation. World Neurosurg. Feb 2017; 98:14-20. PMID 27773858
36. Pan Z, Ha Y, Yi S, et al. Efficacy of transforaminal endoscopic spine system (TESSYS) technique in treating lumbar disc herniation. Med Sci Monit. Feb 18 2016; 22:530-539. PMID 26887645
37. Yao Y, Zhang H, Wu J, et al. Comparison of three minimally invasive spine surgery methods for revision surgery for recurrent herniation after percutaneous endoscopic lumbar discectomy. World Neurosurg. Apr 2017; 100:641-647.e1. PMID 28153616

38. Yao Y, Zhang H, Wu J, et al. Minimally invasive transforaminal lumbar interbody fusion versus percutaneous endoscopic lumbar discectomy: Revision surgery for recurrent herniation after microendoscopic discectomy. World Neurosurg. Mar 2017; 99:89-95. PMID 27919762
39. Gibson JN, Subramanian AS, Scott CE. A randomized controlled trial of transforaminal endoscopic discectomy vs microdiscectomy. Eur Spine J. Mar 2017; 26(3):847-856. PMID 27885470
40. Hsu HT, Chang SJ, Yang SS, et al. Learning curve of full-endoscopic lumbar discectomy. Eur Spine J. Apr 2013; 22(4):727-733. PMID 23076645
41. Kim MJ, Lee SH, Jung ES, et al. Targeted percutaneous transforaminal endoscopic diskectomy in 295 patients: comparison with results of microscopic diskectomy. Surg Neurol. Dec 2007; 68(6):623-631. PMID 18053857
42. Qu JX, Li QZ, Chen M : Comparative study of PTED and MED for monosegment lumbar disc herniation. Chin J Bone Joint Inj. 2017; 32:70-71.
43. Wang H, Cheng J, Xiao H, et al. Adolescent lumbar disc herniation: experience from a large minimally invasive treatment centre for lumbar degenerative disease in Chongqing, China. Clin Neurol Neurosurg. Aug 2013; 115(8):1415-1419. PMID 23419406
44. Zhao W, Li CQ, Zhou Y, et al. Surgical treatment of lumbar disc herniated discs using transforaminal endoscopic surgery system. Orthop J China. 2012; 20:1191-1195.
45. Yoon SM, Ahn SS, Kim KH, et al. Comparative study of the outcomes of percutaneous endoscopic lumbar discectomy and microscopic lumbar discectomy using the tubular retractor system based on the VAS, ODI, and SF-36. Korean J Spine. Sep 2012; 9(3):215-222. PMID 25983818
46. Li M, Yang H, Yang Q. Full-endoscopic technique discectomy versus microendoscopic discectomy for the surgical treatment of lumbar disc herniation. Pain Physician. Jul-Aug 2015; 18(4):359-363. PMID 26218939
47. Sinkemani A, Hong X, Gao ZX, et al. Outcomes of microendoscopic discectomy and percutaneous transforaminal endoscopic discectomy for the treatment of lumbar disc herniation: A comparative retrospective study. Asian Spine J. Dec 2015; 9(6):833-840. PMID 26713113
48. Song HP, Sheng HF, Xu WX. A case-control study on the treatment of protrusion of lumbar intervertebral disc through PELD and MED. Exp Ther Med. Oct 2017; 14(4):3708-3712. PMID 29042967
49. Tu Z, Li YW, Wang B, et al. Clinical outcome of full-endoscopic interlaminar discectomy for single-level lumbar disc herniation: A minimum of 5-year follow-up. Pain Physician. Mar 2017; 20(3):E425-E430. PMID 28339442
50. Li H, Jiang C, Mu X, et al. Comparison of MED and PELD in the treatment of adolescent lumbar disc herniation: A 5-year retrospective follow-up. World Neurosurg. Apr 2018; 112:e255-e260. PMID 29325949
51. Abudurexiti T, Qi L, Muheremu A, et al. Micro-endoscopic discectomy versus percutaneous endoscopic surgery for lumbar disk herniation. J Int Med Res. Sep 2018; 46(9):3910-3917. PMID 29900752
52. Chen Z, Zhang L, Dong J, et al. Percutaneous transforaminal endoscopic discectomy compared with microendoscopic discectomy for lumbar disc herniation: 1-year results of an

ongoing randomized controlled trial. J Neurosurg Spine. Mar 2018; 28(3):300-310. PMID 29303469
53. Liu T, Zhou Y, Wang J, et al. Clinical efficacy of three different minimally invasive procedures for far lateral lumbar disc herniation. Chin Med J (Engl). Mar 2012; 125(6):1082-1088. PMID 22613535
54. Wu XC, Zhou Y, Li CQ. Percutaneous tranforaminal endoscopic discectomy versus microendoscopic discectomy for lumbar disc herniation: a prospective randomized controlled study. J Third Mil Med Univ. 2009; 31(9):843-846.
55. Yang L, Liao XQ, Zhao XJ, et al. Comparison of surgical outcomes between percutaneous transforaminal endoscopic discectomy and micro-endoscopic discectomy for lumbar disc herniation. China J Endosc. 2015; 21(9):962-965.
56. Duan XF, Jin W, Chen JJ, et al. Contrast observation of comparing microendoscopic discectomy with percutaneous endoscopic lumbar discectomy for the treatment of simple lumbar disc herniation. Chin J Clin. 2016; 10(1):144-147.
57. Zhao XW, Han K, Ji ZW, et al. Comparison of efficacy between microendoscopic discectomy and percutaneous endoscopic lumbar discectomy for treatment of lumbar disc herniation. Prog Mod Biomed. 2016; 16(23):4454-4457.
58. Ding YZ, Hu JN, Zhou Y, et al. Study on the effect contrast between microendoscopic discectomy and percutaneous endoscopic lumbar discectomy using TESSYS technique for the treatment of lumbar disc herniation. J Cervicodynia & Lumbodynia. 2017; 38(5):492-493.
59. Li ZY, Guo PG, Han D, et al. Analysis of curative effects and prognosis in different procedures of discectomy for patients with lumbar disc herniation. J Clin Med Pract. 2017; 21(15):149-150, 158.
60. Liu HP, Hao DJ, Wang XD, et al. Comparison of two surgeries in treatment of lumbar disc herniation. Chin J Pain Med. 2017; 23(6):438-442.
61. Luo DK, Zhou NX, Zhao HW, et al. Clinical effectiveness of minimally invasive treatment for lumbar disc herniation. Orthopaedics. 2017; 8(6):439-444.
62. Qu JX, Li QZ, Chem M, et al. Comparison of the efficacies between percutaneous transforaminal endoscopic discectomy and microendoscopic discectomy for the treatment of single-segmental lumbar disc herniation. Chin J Bone Jt Inj. 2017; 32(1):70-71.
63. Chen Q, Qin L, Li MW, et al. Comparison of the therapeutic effect of percutaneous transforaminal endoscopic discectomy and posterior discectomy on senile single segmental lumbar disc herniation. Chin J Front Med Sci. 2018; 10(2):60-64.
64. Wu YM, Bai M, Yin HP, et al. Comparison of the efficacies between two kinds of minimally invasive procedures for the treatment of simple lumbar disc herniation. J Pract Orthop. 2018; 24(4):357-360.
65. Belykh E, Giers MB, Preul MC, et al. Prospective comparison of microsurgical, tubular-based endoscopic, and endoscopically assisted diskectomies: Clinical effectiveness and complications in railway workers. World Neurosurg. Jun 2016; 90:273-280. PMID 26898494
66. Chen HC, Lee CH, Wei L, et al. Comparison of percutaneous endoscopic lumbar discectomy and open lumbar surgery for adjacent segment degeneration and recurrent disc herniation. Neurol Res Int. 2015; 2015:791943. PMID 25861474

67. Choi KC, Kim JS, Park CK. Percutaneous endoscopic lumbar discectomy as an alternative to open lumbar microdiscectomy for large lumbar disc herniation. Pain Physician. Feb 2016; 19(2):E291-E300. PMID 26815256
68. Garg B, Nagraja UB, Jayaswal A. Microendoscopic versus open discectomy for lumbar disc herniation: a prospective randomised study. J Orthop Surg (Hong Kong). Apr 2011; 19(1):30-34. PMID 21519072
69. Hermantin FU, Peters T, Quartararo L, et al. A prospective, randomized study comparing the results of open discectomy with those of video-assisted arthroscopic microdiscectomy. J Bone Joint Surg Am. Jul 1999; 81(7):958-965. PMID 10428127
70. Huang TJ, Hsu RW, Li YY, et al. Less systemic cytokine response in patients following microendoscopic versus open lumbar discectomy. J Orthop Res. Mar 2005; 23(2):406-411. PMID 15734255
71. Hussein M, Abdeldayem A, Mattar MM. Surgical technique and effectiveness of microendoscopic discectomy for large uncontained lumbar disc herniations: a prospective, randomized, controlled study with 8 years of follow-up. Eur Spine J. Sep 2014; 23(9):1992-1999. PMID 24736930
72. Kleinpeter G, Markowitsch MM, Bock F. Percutaneous endoscopic lumbar discectomy: minimally invasive, but perhaps only minimally useful? Surg Neurol. Jun 1995; 43(6):534-539; discussion 540-541. PMID 7482230
73. Lee DY, Shim CS, Ahn Y, et al. Comparison of percutaneous endoscopic lumbar discectomy and open lumbar microdiscectomy for recurrent disc herniation. J Korean Neurosurg Soc. Dec 2009; 46(6):515-521. PMID 20062565
74. Martin-Laez R, Martinez-Agueros JA, Suarez-Fernandez D, et al. Complications of endoscopic microdiscectomy using the EASYGO! system: Is there any difference with conventional discectomy during the learning-curve period? Acta Neurochir (Wien). Jun 2012; 154(6):1023-1032. PMID 22446750
75. Mayer HM, Brock M. Percutaneous endoscopic discectomy: surgical technique and preliminary results compared to microsurgical discectomy. J Neurosurg. Feb 1993; 78(2):216-225. PMID 8267686
76. Ohya J, Oshima Y, Chikuda H, et al. Does the microendoscopic technique reduce mortality and major complications in patients undergoing lumbar discectomy? A propensity score-matched analysis using a nationwide administrative database. Neurosurg Focus. Feb 2016; 40(2):E5. PMID 26828886
77. Pan L, Zhang P, Yin Q. Comparison of tissue damages caused by endoscopic lumbar discectomy and traditional lumbar discectomy: a randomised controlled trial. Int J Surg. 2014; 12(5):534-537. PMID 24583364
78. Righesso O, Falavigna A, Avanzi O. Comparison of open discectomy with microendoscopic discectomy in lumbar disc herniations: Results of a randomized controlled trial. Neurosurgery. Sep 2007; 61(3):545-549; discussion 549. PMID 17881967
79. Ruetten S, Komp M, Merk H, et al. Full-endoscopic interlaminar and transforaminal lumbar discectomy versus conventional microsurgical technique: a prospective, randomized, controlled study. Spine (Phila Pa 1976). Apr 20 2008; 33(9):931-939. PMID 18427312
80. Ruetten S, Komp M, Merk H, et al. Recurrent lumbar disc herniation after conventional discectomy: a prospective, randomized study comparing full-endoscopic interlaminar and

transforaminal versus microsurgical revision. J Spinal Disord Tech. Apr 2009; 22(2):122-129. PMID 19342934
81. Sasaoka R, Nakamura H, Konishi S, et al. Objective assessment of reduced invasiveness in MED. Compared with conventional one-level laminotomy. Eur Spine J. May 2006; 15(5):577-582. PMID 15926058
82. Schizas C, Tsiridis E, Saksena J. Microendoscopic discectomy compared with standard microsurgical discectomy for treatment of uncontained or large contained disc herniations. Neurosurgery. Oct 2005; 57(4 Suppl):357-360; discussion 357-360. PMID 16234685
83. Teli M, Lovi A, Brayda-Bruno M, et al. Higher risk of dural tears and recurrent herniation with lumbar micro- endoscopic discectomy. Eur Spine J. Mar 2010; 19(3):443-450. PMID 20127495
84. Ruetten S, Komp M, Merk H, et al. Use of newly developed instruments and endoscopes: full-endoscopic resection of lumbar disc herniations via the interlaminar and lateral transforaminal approach. J Neurosurg Spine. Jun 2007; 6(6):521-530. PMID 17561740
85. Ruetten S, Komp M, Merk H, et al. Full-endoscopic cervical posterior foraminotomy for the operation of lateral disc herniations using 5.9-mm endoscopes: a prospective, randomized, controlled study. Spine (Phila Pa 1976). Apr 20 2008; 33(9):940-948. PMID 18427313
86. Lee SH, Chung SE, Ahn Y, et al. Comparative radiologic evaluation of percutaneous endoscopic lumbar discectomy and open microdiscectomy: a matched cohort analysis. Mt Sinai J Med. Sep 2006; 73(5):795-801. PMID 17008941
87. Gadjradj PS, Rubinstein SM, Peul WC, et al. Full endoscopic versus open discectomy for sciatica: randomised controlled non-inferiority trial. BMJ. Feb 21 2022; 376:e065846. PMID 35190388
88. Ran B, Wei J, Yang J, et al. Quantitative Evaluation of the Trauma of CT Navigation PELD and OD in the Treatment of HLDH: A Randomized, Controlled Study. Pain Physician. Jul 2021; 24(4):E433-E441. PMID 34213868
89. Wang F, Guo D, Sun T, et al. A comparative study on short-term therapeutic effects of percutaneous transforaminal endoscopic discectomy and microendoscopic discectomy on lumbar disc herniation. Pak J Med Sci. Mar-Apr 2019; 35(2):426-431. PMID 31086527
90. Liu Y, Kim Y, Park CW, et al. Interlaminar Endoscopic Lumbar Discectomy Versus Microscopic Lumbar Discectomy: A Preliminary Analysis of L5-S1 Lumbar Disc Herniation Outcomes in Prospective Randomized Controlled Trials. Neurospine. Dec 2023; 20(4):1457-1468. PMID 38171312
91. Yang X, Zhang S, Su J, et al. Comparison of Clinical and Radiographic Outcomes Between Transforaminal Endoscopic Lumbar Discectomy and Microdiscectomy: A Follow-up Exceeding 5 Years. Neurospine. Mar 2024; 21(1):303-313. PMID 38317550
92. Saghebdoust S, Khadivar F, Ekrami M, et al. Transforaminal Endoscopic Lumbar Diskectomy versus Open Microdiskectomy for Symptomatic Lumbar Disk Herniation: A Comparative Cohort Study on Costs and Long-Term Outcomes. J Neurol Surg A Cent Eur Neurosurg. Oct 25 2023. PMID 37879346
93. Lee DY, Lee SH. Learning curve for percutaneous endoscopic lumbar discectomy. Neurol Med Chir (Tokyo). Sep 2008; 48(9):383-388; discussion 388-389. PMID 18812679

94. Wang B, Lu G, Patel AA, et al. An evaluation of the learning curve for a complex surgical technique: the full endoscopic interlaminar approach for lumbar disc herniations. Spine J. Feb 2011; 11(2):122-130. PMID 21296295
95. Tenenbaum S, Arzi H, Herman A, et al. Percutaneous posterolateral transforaminal endoscopic discectomy: clinical outcome, complications, and learning curve evaluation. Surg Technol Int. Dec 2011; 21:278-283. PMID 22505002
96. Casal-Moro R, Castro-Menendez M, Hernandez-Blanco M, et al. Long-term outcome after microendoscopic diskectomy for lumbar disk herniation: a prospective clinical study with a 5-year follow-up. Neurosurgery. Jun 2011; 68(6):1568-1575; discussion 1575. PMID 21311384
97. Wang M, Zhou Y, Wang J, et al. A 10-year follow-up study on long-term clinical outcomes of lumbar microendoscopic discectomy. J Neurol Surg A Cent Eur Neurosurg. Aug 2012; 73(4):195-198. PMID 22825836
98. Choi KC, Lee JH, Kim JS, et al. Unsuccessful percutaneous endoscopic lumbar discectomy: a single-center experience of 10,228 cases. Neurosurgery. Apr 2015; 76(4):372-381. PMID 25599214
99. National Institute for Health and Care Excellence (NICE). Automated percutaneous mechanical lumbar discectomy-guidance [IPG141]. 2005; Available at <https://guidance.nice.org.uk> (accessed April 17, 2024).
100. National Institute for Health and Care Excellence (NICE). Percutaneous interlaminar endoscopic lumbar discectomy for sciatica [IPG555]. 2016; Available at <https://www.nice.org.uk> (accessed April 17, 2024).
101. National Institute for Health and Care Excellence (NICE). Percutaneous transforaminal endoscopic lumbar discectomy for sciatica [IPG556]. 2016; Available at <https://www.nice.org.uk> (accessed April 17, 2024).
102. Kreiner DS, Hwang SW, Easa JE, et al. An evidence-based clinical guideline for the diagnosis and treatment of lumbar disc herniation with radiculopathy. Spine J. Jan 2014; 14(1):180-191. PMID 24239490
103. Chou R, Loeser JD, Owens DK, et al. Interventional therapies, surgery, and interdisciplinary rehabilitation for low back pain: an evidence-based clinical practice guideline from the American Pain Society. Spine (Phila Pa 1976). May 1 2009; 34(10):1066-1077. PMID 19363457
104. Sayed D, Grider J, Strand N, et al. The American Society of Pain and Neuroscience (ASPN) Evidence-Based Clinical Guideline of Interventional Treatments for Low Back Pain. J Pain Res. 2022; 15:3729-3832. PMID 36510616

Centers for Medicare and Medicaid Services (CMS)

The information contained in this section is for informational purposes only. HCSC makes no representation as to the accuracy of this information. It is not to be used for claims adjudication for HCSC Plans.

The Centers for Medicare and Medicaid Services (CMS) does not have a national Medicare coverage position. Coverage may be subject to local carrier discretion.

A national coverage position for Medicare may have been developed since this medical policy document was written. See Medicare's National Coverage at <https://www.cms.hhs.gov>.

Policy History/Revision	
Date	**Description of Change**
10/15/2025	Reviewed. No changes.
10/15/2024	Document updated with literature review. Coverage unchanged. Added references 90-92.
02/01/2024	Document updated with literature review. Coverage unchanged. Added references 11-23, 87, 88, and 103.
10/01/2022	Reviewed. No changes.
11/01/2021	Document updated with literature review. Coverage unchanged. The following references were added: 7-27, 29-41, 43-57, 60, 62-68, 71, 72, 74, 77-80, 93 and 94.
09/15/2020	Reviewed. No changes.
04/01/2019	Policy updated with literature review. Coverage unchanged. Reference 21 added, others updated.
06/15/2018	Reviewed. No changes.
02/15/2018	Document updated with literature review. Coverage has changed, the word percutaneous was added to the following coverage statement: Percutaneous endoscopic discectomy is considered experimental, investigational and/or unproven as a technique of intervertebral disc decompression in patients with back pain and/or radiculopathy related to disc herniation in the lumbar, thoracic, or cervical spine. The Title has changed from: Automated Percutaneous Discectomy and Endoscopic Discectomy.
09/15/2016	Document updated with literature review. Coverage unchanged.
07/01/2015	Reviewed. No changes.
08/01/2014	Medical document divided into: SUR712.023, SUR712.037 and SUR712.038. Document title changed from “Intervertebral Techniques to Treat Chronic Discogenic Back Pain”. Document updated with literature review. The previous coverage statement was Percutaneous discectomy by any means is considered experimental, investigational and/or unproven as a technique of intervertebral disc decompression in patients with back pain related to disc herniation in the lumbar, thoracic or cervical spine. The following was added to coverage: Endoscopic discectomy is considered experimental, investigational and/or unproven as a technique of intervertebral disc decompression in patients with back pain and/or radiculopathy related to disc herniation in the lumbar, thoracic, or cervical spine.

06/01/2012	Coverage revised, the following was added; Axial lumbosacral interbody fusion (axial LIF) is considered experimental, investigational and unproven. Description, rationale, and references updated.
12/15/2011	Document updated with literature review. Document completely revised. All references to minimally invasive interbody fusion were removed. Title was changed from “Percutaneous Intervertebral Techniques to Treat Chronic Discogenic Back pain”.
12/15/2009	Coverage revised
12/01/2008	Coverage Revised. Codes Revised/Added/Deleted
05/01/2008	Revised/Updated Entire Document
06/01/2006	Revised/Updated Entire Document
11/01/2004	New Medical Document