

Laser Spine Surgery



**DEFINING APPROPRIATE
COVERAGE POSITIONS**

Introduction

North American Spine Society (NASS) coverage policy recommendations are intended to assist payers and members by proactively defining appropriate coverage positions. Historically, NASS has provided comment on payer coverage policy upon request. However, in considering coverage policies received by the organization, NASS believes proactively examining medical evidence and recommending credible and reasonable positions may be to the benefit of both payers and members in helping achieve consensus on coverage before it becomes a matter of controversy.

With regard to laser spine surgery, there are two approaches. One is percutaneous. A needle is inserted into the appropriate disc (lumbar or cervical). Thereafter, a cannula is placed over the needle and a laser is introduced. The laser is used to cauterize the disc tissue thus reducing the herniation.

The alternative approach is an open approach posteriorly. After completion of a laminoforaminotomy either in the lumbar or cervical spine, laser cauterization is used to reduce the disc herniation under direct visualization.

Methodology

The coverage policies put forth by NASS use an evidence-based approach to spinal care when possible. In the absence of strict evidence-based criteria, policies reflect the multidisciplinary and non-conflicted experience and expertise of the authors in order to reflect reasonable standard practice indications in the United States.

[NASS Coverage Policy Methodology](#)

Medline, Cochrane, and Scopus databases were searched using criteria below. Abstracts (216) that met search criteria were reviewed. Thirteen articles were reviewed from the selected abstract. These represented the highest quality data (systematic reviews). No RCTs were available. There was one case-control study and multiple case reports.

Search Strategy

Medline

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

Database(s): **Ovid MEDLINE(R)** 1946 to February Week 4 2013

Search Strategy:

#	Searches	Results
1	Laser Therapy/	31072
2	exp Laser Therapy, Low-Level/	2677
3	exp Lasers/	36687
4	laser\$.ti.	54272
5	or/1-4	77302
6	exp Spine/	99804
7	exp Intervertebral Disc/	9755
8	exp Back Pain/	26787
9	exp Spinal Diseases/	87750
10	or/6-9	166749
11	5 and 10	429
12	limit 11 to (english language and humans and yr="1990 -Current")	256
13	limit 12 to (comment or editorial or letter or news)	15

Page 2 of 12

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

14	12 not 13	241
15	cadav\$.mp.	51296
16	14 not 15	<i>Downloaded for review</i>
		231

Cochrane Library (Reviews, CENTRAL, CDMR, HTA)

#	Searches	Results
1	[Laser Therapy] this term only	1589
2	[Laser Therapy, Low-Level] explode all trees	387
3	[Lasers] explode all trees	1090
4	laser\$.ti.	4408
5	or/1-4	5106
6	[Spine] explode all trees	3162
7	[Intervertebral Disc] explode all trees	200
8	[Back Pain] explode all trees	2476
9	[Spinal Diseases] explode all trees	2040
10	or/6-9	6249

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

11	"back" or "cervical" or "lumbar" or "disk" or "spinal" or "spine" or "discectom*" or "decompress*" or "laminotom*" or "foramin*":ti	429
12	10 or 11	16268
13	5 and 12 (limit 13 to (yr="1990 -Current")) <i>Downloaded for review</i>	139

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

Scopus – Embase and Medline

#	Searches	Results
1	"laser therapy" OR "laser surgery"	38,892
2	"laser*" .ti.	65,590
3	"back" OR "cervical" OR "lumbar" OR "disk" OR "spinal" OR "spine" OR "discectom*" OR "decompress*" OR "laminotom*" OR "foramin*" .ti.	266,628
4	1 or 2	81,933
5	3 and 4	1,047
6	cadaver*	67,174
7	5 not 6	1,038
8	"case report*" OR "comment*" OR "editorial" OR "letter" OR "reply"	2,877,635
9	7 not 8	926
10	(limit 9 to (yr="1990 -Current")) <i>Downloaded for review</i>	604

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

Scope and Clinical Indications

Clinical Indications for the Procedure

Laser spine surgery in the **cervical** or **lumbar** spine is NOT indicated at this time. Due to lack of high quality clinical trials concerning laser spine surgery with the cervical or lumbar spine, it cannot be endorsed as an adjunct to open, minimally invasive, or percutaneous surgical techniques.

Coverage Recommendation(s)

Cervical and Lumbar Laser Spine Surgery

There are no high quality studies to support a recommendation for cervical or lumbar laser spine surgery. When evaluating efficacy of a newer therapy, randomized controlled trials (RCTs) with long-term follow-up that compare the investigated treatment versus current standard practice are paramount in deciding utility of the new therapy. To achieve a quality clinical study, an RCT needs to possess the following elements:

Randomization: Undertaken to minimize bias in the treatment and control groups with preclinical characteristics, outcome observations and treatments other than the investigate element similar.

Appropriate control group: Since surgical decompression is the standard care for the operative approach, this should represent the control group with both patients and outcome observers blinded.

Large study population: Small studies do not permit careful detection of important outcomes and small case series are prone to bias

Adequate follow-up: The results of surgical improvement diminish overtime emphasizing the importance of long-term follow-up.

Rationale

Lumbar Laser Spine Surgery

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

With regard to lumbar laser spine surgery, a Cochrane Review (2007 Gibson and Waddell) reported on three clinical trials: one comparing two types of lasers, one comparing laser surgery to chemonucleolysis, and one comparing laser surgery to epidural steroid injections. The first trial reported no difference between types of laser techniques. The second trial reported a slight benefit with chemonucleolysis while the third trial reported no difference between laser surgery and epidural injection. The authors concluded that too much trial variability existed to pool the patients for meta-analysis.

Goupille et al. (2007) completed a systematic review of lumbar laser spine surgery reviewing Medline, Embase, and Cochrane databases over a 26-year period up through 2006. They reported no consensus on technique and inadequate control groups for comparison. The authors reported a 75% success rate but that the variability in trial and reports indicated that the treatment outcomes could not be validated.

Singh et al. (2009) completed a systematic review of lumbar laser spine surgery reviewing Medline, Embase, and Cochrane databases as well. They found 33 observational data but a paucity of controlled studies. The minimum criterion for improvement was a 2 point or 30% reduction of pain scores with 10% improvement in functional outcomes. They identified a total of 2447 patients from published studies, 72% of whom fulfilled the criterion for improvement (1774). From the data they reviewed, the authors concluded that level II-2 evidence (U.S. Preventive Services Task Force) existed for percutaneous laser decompression for short (less than one year) and long-term (more than one year) pain relief. Tassi (2006) reported a lower quality case-control study of 1000 patients who underwent standard lumbar laminotomy and microdiscectomy (500 patients, 6 surgeons) or percutaneous laser discectomy (500 patients, 1 surgeon). Outcomes were assessed using the Macnab criteria (non-validated). Over a 2 year period, the laser group had 83.8% good or excellent outcomes compared to 85.6% with open surgery. Of note, assessments were in the early postoperative period (less than 12 weeks). The complication rate was 0% with laser discectomy and 2.2% with open discectomy. Length-of-stay was shorter in the laser group.

Lee et al. (1996) compared outcomes of patients undergoing one of three procedures: percutaneous endoscopic laser discectomy, chemonucleolysis, and automated percutaneous lumbar discectomy (100 patients in each arm, 300 total). Outcomes were examined using self-assessment (Macnab criteria). In the laser group, good or better results were observed in 68%, while it was 55% in the chemonucleolysis group, and 48% in the automated discectomy group.

Menchetti et al. (2011) reported on 900 patients who underwent percutaneous laser discectomy with 5 year follow-up. Outcomes were measured using VAS and Macnab criteria. The VAS improved from 8.5 to 3.4; 68% reported good or better outcomes according to Macnab criteria.

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

Caspar et al. (1996) reported on 100 patients who underwent lumbar laser discectomy using 2 year Macnab criteria outcomes. They reported 86.9% good or better outcomes at 2 years. However, 10 patients had to undergo repeat surgeries. In this group, 80% good or better outcomes were reported at 6 months.

Lee and Lee (2011) reported on 31 patients who underwent an open far lateral foraminotomy with laser assistance at L5-S1. They reported 1 year follow-up using VAS back and leg pain and Oswestry Disability Index scores. Average VAS back and leg pain and ODI scores were better at 1 year follow-up.

With regard to complications, Knight et al. (2001) reported on 716 patients who underwent 958 endoscopic laser foraminoplasties. They noted 9 cases of discitis, 1 durotomy, 1 deep wound infection, 2 neurological injuries, 1 myocardial infarction, and 1 erectile dysfunction. Overall incidence of complications was 1.6%. They compared this to a historical control of 6% for open surgery. In contrast, Takeno et al. (2006) reported on 13 patients who underwent percutaneous laser decompression (10 lumbar disc herniations and 3 spondylolistheses). Re-exploration and pathological study revealed osteonecrosis of the vertebral endplates, adhesions, and carbon fragments.

To summarize, three systematic reviews found no clear evidence to benefit lumbar laser spine surgery. Three case-control studies were found. The Tassi (2006) study compared two different populations, unblinded, at different times and with biased follow-up. The Lee et al. (1996) study compared three groups, none of whom underwent open lumbar decompression, while the Knight et al. study (2001) used historical controls. The remaining studies were case reports that found similar outcomes as that of Singh et al. (2009), which documented an approximate 70% satisfaction rate but without sound data about clinical or functional improvement.

Cervical Laser Spine Surgery

Ahn et al. (2012) reported on 47 patients who underwent posterior cervical laminoforaminotomy and discectomy; 24 patients had laser assistance while 23 underwent conventional disc removal. The choice of procedure was decided by the surgeon without blinding to the patient or observer. Follow-up was over 2 years. Average VAS arm pain improved from 7.42 to 1.83 in the laser group and 8.30 to 1.65 in the conventional group. Neck Disability Index improved from 47.0% to 10.5% in the laser group and 53.9% to 10.1% in the conventional group. Macnab good or better outcomes were reported in 87.5% of patients in the laser group and 86.9% in the open group. Blood loss was significantly less in the laser group.

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

Lee et al. (2006) reported on 60 patients who underwent percutaneous laser anterior cervical discectomy. Follow-up at 5 year used Macnab criteria and VAS pain scores. The VAS was significantly improved from 7.9 preoperatively to 2.6 at the final follow-up ($p < 0.001$). In addition, 51 (85.0%) patients achieved a favorable outcome according to Macnab criteria. Immediate (within 24 h) pain relief was achieved in 19 patients, and it was strongly related to long-term success ($p = 0.006$).

Lee et al. (2008) compared patients who underwent laser-assisted cervical corpectomy (21 patients) to those who underwent laminoplasty (27 patients) for ossification of the posterior longitudinal ligament. Outcomes were assessed using Nurick criteria (not validated), diameter of canal, Cobb angle, ROM. Nurick improved 1.9 grades with anterior surgery versus 1.0 with posterior surgery. Diameter improved 9.1 mm with anterior surgery versus 4.1 mm with posterior surgery. Cobb angles were more favorable with an anterior approach and ROM was similar. However, the surgical approaches were both open with minimal influence of laser devices on the applied technique.

Haufe and Mork (2004) reported on 41 patients who underwent percutaneous cervical anterior discectomy. The reported 2 patients had vascular injury, one had recurrent laryngeal palsy, and 1 had discitis.

To summarize, one case-control study (Ahn et al. 2012) on posterior decompression with laser assistance reported similar outcomes to an open approach with laser assistance versus open approach alone. Though less blood loss was noted with the laser surgery, this was not associated with improved outcomes. For anterior cervical surgery, one study (Lee et al. 2006) indicated functional improvement with percutaneous anterior cervical discectomy but no control group was presented. Another series (Haufe and Mork 2004) presented complications with this approach.

References

Ahn, Y., K. S. Moon, B.-U. Kang, S. M. Hur and J. D. Kim (2012). "Laser-assisted posterior cervical foraminotomy and discectomy for lateral and foraminal cervical disc herniation." *Photomedicine and Laser Surgery* 30(9): 510-515.

Lee, D. Y. and S.-H. Lee (2011). "Carbon dioxide (CO₂) laser-assisted microdiscectomy for extraforaminal lumbar disc herniation at the L5-S1 level." *Photomedicine and Laser Surgery* 29(8): 531-535.

Menchetti, P. P. M., G. Canero and W. Bini (2011). "Percutaneous laser discectomy: experience and long

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

term follow-up." *Acta Neurochirurgica - Supplement* 108: 117-121.

Singh, V., L. Manchikanti, R. M. Benyamin, S. Helm and J. A. Hirsch (2009). "Percutaneous lumbar laser disc decompression: a systematic review of current evidence." *Pain Physician* 12(3): 573-588.

Lee, S.-H., Y. Ahn and J. H. Lee (2008). "Laser-assisted anterior cervical corpectomy versus posterior laminoplasty for cervical myelopathic patients with multilevel ossification of the posterior longitudinal ligament." *Photomedicine and Laser Surgery* 26(2): 119-127.

Gibson, J. N. A. and G. Waddell (2007). "Surgical interventions for lumbar disc prolapse: updated Cochrane Review." *Spine* 32(16): 1735-1747.

Goupille, P., D. Mulleman, S. Mammou, I. Griffoul and J.-P. Valat (2007). "Percutaneous laser disc decompression for the treatment of lumbar disc herniation: a review." *Seminars in Arthritis & Rheumatism* 37(1): 20-30.

Lee, S.-H., Y. Ahn, W.-C. Choi, A. Bhanot and S.-W. Shin (2006). "Immediate pain improvement is a useful predictor of long-term favorable outcome after percutaneous laser disc decompression for cervical disc herniation." *Photomedicine and Laser Surgery* 24(4): 508-513.

Takeo, K., S. Kobayashi, T. Yonezawa, K. Hayakawa, Y. Hachiya, K. Uchida, K. Negoro, G. Timbihurira and H. Baba (2006). "Salvage operation for persistent low back pain and sciatica induced by percutaneous laser disc decompression performed at outside institution: correlation of magnetic resonance imaging and intraoperative and pathological findings." *Photomedicine and Laser Surgery* 24(3): 414-423.

Tassi, G. P. (2006). "Comparison of results of 500 microdiscectomies and 500 percutaneous laser disc decompression procedures for lumbar disc herniation." *Photomedicine and Laser Surgery* 24(6): 694-697.

Haufe, S. M. W. and A. R. Mork (2004). "Complications associated with cervical endoscopic discectomy with the holmium laser." *Journal of Clinical Laser Medicine & Surgery* 22(1): 57-58.

Knight, M. T., D. R. Ellison, A. Goswami and V. F. Hillier (2001). "Review of safety in endoscopic laser

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.

foraminoplasty for the management of back pain." Journal of Clinical Laser Medicine & Surgery 19(3): 147-157.

Casper, G. D., V. L. Hartman and L. L. Mullins (1996). "Results of a clinical trial of the holmium:YAG laser in disc decompression utilizing a side-firing fiber: a two-year follow-up." Lasers in Surgery & Medicine 19(1): 90-96.

Lee, S. H., S. J. Lee, K. H. Park, I. M. Lee, K. H. Sung, J. S. Kim and S. Y. Yoon (1996) Comparison of percutaneous manual and endoscopic laser discectomy with chemonucleolysis and automated nucleotomy. Orthopade 49-55.

Author Disclosures

Matz, Paul G.: Speaking and/or Teaching Arrangements: AO Spine North America (Financial, Honoraria for Faculty at AO Advance Concepts Courses and AO Aging Bone Symposium, B).

NASS coverage recommendations should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution. **The coverage recommendations do not represent a "standard of care,"** nor are they intended as a fixed treatment protocol. It is anticipated that there will be patients who will require less or more treatment than the average. It is also acknowledged that in atypical cases, treatment falling outside these criteria will sometimes be necessary. This document should not be seen as prescribing the type, frequency or duration of intervention. Treatment and accompanying payment should be based on this information in addition to an individual patient's needs as well as the doctor's professional judgment and experience. This document is designed to function as a guide and should not be used as the sole reason for denial of treatment and services. It is not intended to supersede applicable ethical standards or provisions of law. This is not a legal document.