NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of percutaneous interlaminar endoscopic lumbar discectomy for sciatica

The tough covering of a spinal disc (annulus) can sometimes break, allowing the soft centre to bulge through. This is called herniation, also known as 'slipped disc'. It may cause pain in the back, pain in the leg (sciatica), and numbness and weakness in the leg. In this procedure, the bulging part of the disc is removed through the interlaminar space (a natural opening between the spinal bones, or vertebrae) using an endoscope (a thin tube with a camera on the end) through a small cut in the back. The aim is to remove the pressure on the nerve to relieve symptoms.

Introduction

The National Institute for Health and Care Excellence (NICE) has prepared this interventional procedure (IP) overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This IP overview was prepared in April 2015 and updated in January 2016.

Procedure name

- Percutaneous interlaminar endoscopic lumbar discectomy for sciatica

Specialist societies

- British Association of Spinal Surgeons
- Society of British Neurological Surgeons
- UK Spine Societies Board Ltd.

Description

Indications and current treatment

Lumbar disc herniation occurs when the nucleus pulposus of an intervertebral disc protrudes through a tear in the surrounding annulus fibrosus. Symptoms include pain in the back or leg, and numbness or weakness in the leg. Serious neurological sequelae including painful foot drop, bladder dysfunction, and cauda equina syndrome, may sometimes occur.

Conservative treatments include analgesics, non-steroidal anti-inflammatory medication, manual therapy and acupuncture. Epidural corticosteroid injections can also be used to reduce nerve pain in the short term. Lumbar discectomy is considered if there is severe nerve compression or persistent symptoms that are unresponsive to conservative treatment. Surgical techniques include open discectomy, microdiscectomy or minimally invasive alternatives using percutaneous endoscopic approaches. The choice of operative technique may be influenced by several factors, including the presenting symptoms and signs, and the location and size of the disc prolapse.

What the procedure involves

Percutaneous endoscopic lumbar discectomy aims to preserve bony structures and cause less damage to paravertebral muscles and ligaments than open discectomy, allowing a shorter hospital stay and faster recovery. An interlaminar approach provides an alternative to the transforaminal approach for treating central or centro-lateral disc extrusions, especially at the L5-S1 level where the transforaminal approach is difficult.

Percutaneous interlaminar endoscopic lumbar discectomy is usually done with the patient in the prone position using local or general anaesthesia. Under fluoroscopic guidance, a guidewire is inserted into the appropriate interlaminar space. Dilators are used to expose the ligamentum flavum and the ruptured disc is accessed through this ligament. An endoscope and rongeurs are used to remove the herniated disc fragments. A laser may also be used to aid removal of the disc. The patient can usually mobilise within a few hours of the procedure.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to percutaneous interlaminar endoscopic lumbar discectomy for sciatica. The following databases were searched, covering the period from their start to 5 January 2016: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and

other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with sciatica.
Intervention/test	Percutaneous interlaminar endoscopic lumbar discectomy.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the IP overview

This IP overview is based on 2925 patients from 4 comparative studies and 4 case series.

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on percutaneous interlaminar endoscopic lumbar discectomy for sciatica

Study 1 Ruetten S (2008)

Details

Study type	**Prospective comparative controlled trial**
Country	Germany
Recruitment period	2004
Study population and number	n=**200 (100 full-endoscopic [FE] discectomy [59 interlaminar and 41 transforaminal] versus 100 conventional microsurgical [MI] technique)** patients with clinically symptomatic disc herniation
Age and sex	Mean 43 years; 42% (84/200) male
Patient selection criteria	All forms of disc herniations were included and alternatively assigned to the FE or MI group. - In the FE group, the inclusion criteria for the IL access were disc herniations located mainly inside the spinal canal; for the TF access, the inclusion criteria were all extra- and intraforaminal disc herniations and herniated disc within the spinal canal when there was sequestering of material located cranially below the lower edge of the cranial pedicle or caudally not over the middle of the caudal pedicle and lateral radiologic evidence that the foramen was not overlaid by the pelvis beyond the middle of the cranial pedicle. -In the MI group, all disc herniations localised within the spinal canal were operated under paramedian IL access. For intra- or extraforaminal herniations, a lateral foraminal access was used.
Technique	-FE procedures: IL and TF approaches. All the instruments and optics were supplied by WOLF. -The conventional MI procedures were performed with paramedian or lateral access in known standardised technique using a microscope. The procedures were all performed under general anaesthesia. Drainage was only applied in the MI group. Sequestrotomy alone was performed in small or covered annular defects when the sequestered disc material exceeded the level of the intervertebral space toward cranial or caudal (39 FE, 43 MI).
Follow-up	**24 months**
Conflict of interest/source of funding	None

Analysis

Follow-up issues:

- At day 1, 100% (200/200) of patients had a follow-up examination; at 3 months, 97% (193/200); at 6 months, 95% (189/200); at 12 months, 93% (185/200), and at 24 months, 89% (178/200).
- After 2 years, the 89% of patients still included in the study had been treated by the following procedures: 91 FE (53 IL, 38 TF) and 87 MI.
- The 11% (22/200) of patients who were missing 2 years after the procedure were lost for the following reasons: 1 procedure-unrelated death, 3 patients moved away and left no forwarding address, 12 patients did not respond to letters or telephone call, 3 patients were treated by revision surgery with conventional spinal canal decompression and 3 were treated by fusion.

Study design issues:

- The follow-up examinations were performed by 2 physicians not involved in the procedures.
- Group allocation was open and made by non-physician study staff alternately to the FE or MI group in the sequence of presentation. The surgeon in each case selected the access within the FE and MI groups.
- All procedures were performed by 2 surgeons experienced in both techniques.

Study population issues:

- The duration of pain ranged from 1 day to 16 months (mean 82 days).
- 81% (162/200) of patients had received a mean of 9 weeks of conservative treatments.
- 77 interventions were performed at the L5-S1 level (36 IL, 2 TF, 39 MI), 64 at L4-L5 (13 IL, 20 TF, 31 MI), 45 at L3-L4 (7 IL, 13 TF, 25 MI), 12 at L2-L3 (3 IL, 4 TF, 5 MI), and 2 at L1-L2 (2TF).

Other issues: Clinical outcomes and patient satisfaction outcomes were given for the whole FE group and no distinction was made between IL and TF approaches. Therefore these data were not extracted from the paper.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **200 (100 FE discectomy [59 IL and 41 TF] versus 100 MI technique)**

Operative time (mean, range)

- FE group: 22 min (13-46 min)
- MI group: 43 min (34-72 min)
- Significant difference between groups ($p < 0.001$)
- Within the FE group there was no significant difference between IL (13-46 min) and TF (14-37 min).

Blood loss (mean intra- and post-operative)

- FE group: no measurable blood loss
- MI group: 45 ml (5-235 ml)

Access-related osseous resection was needed in 17% of patients (17/100) in the FE group (13 IL, 4 TF) and in 91% (91/100) of patients in the MI group (significant difference between FE and MI groups, $p < 0.001$).

Recurrence at 2-year follow-up

	IL group (n=53)	**TF group (n=38)**	**MI group (n=87)**
Recurrence rate	6% (3/53)	8% (3/38)	6% (5/87)

No significant differences between groups.

All patients with recurrence were treated a second time by the same technique as before.

In the TF group, 2 patients had another recurrence.

Safety

Perioperative complications

Complication	**IL group (n=59)**	**TF group (n=41)**	**MI group (n=100)**
Transient dysesthesia	3% (2/59)	2% (1/41)	5% (5/100)
Bleeding	0	0	2% (2/100)
Delayed wound-healing	0	0	1% (1/100)
Soft tissue infection	0	0	1% (1/100)
Transient urinary retention	0	0	3% (3/100)

Overall, the complication rate was significantly higher in the MI group ($p < 0.05$).

Abbreviations used: FE, full-endoscopic; IL, interlaminar; MI, microsurgical; TF, transforaminal.

Study 2 Ruetten S (2009)

Details

Study type	**Prospective comparative controlled trial**
Country	Germany
Recruitment period	2004-2005
Study population and number	n=**100 (50 FE discectomy [29 interlaminar and 21 transforaminal] versus 50 conventional MI technique)** patients with clinically symptomatic recurrent lumbar disc herniation after conventional discectomies
Age and sex	Mean 39 years; 56% (56/100) male
Patient selection criteria	Patients who had been treated by previous conventional discectomy, who presented with acute occurrence of radicular leg symptoms on the same side after a pain-free interval and who showed a recurrent disc herniation in the same level in a magnetic resonance imaging with contrast medium. All forms of recurrent disc herniations located inside the spinal canal were included and alternatively assigned to the FE or MI group. - In the FE group, the inclusion criteria for the IL access were disc herniations technically difficult to treat using the TF technique. The TF technique was the access of choice when there was sequestering of material located cranially below the lower edge of the cranial pedicle or caudally not over the middle of the caudal pedicle and lateral radiologic evidence that the foramen was not overlaid by the pelvis beyond the middle of the cranial pedicle. -In the MI group, all disc herniations localised were operated under paramedian IL access.
Technique	-FE procedures: IL and TF approaches. All the instruments and optics were supplied by WOLF. -The conventional MI procedures were performed with paramedian access in known standardised technique using a microscope. The procedures were all performed under general anaesthesia. Drainage was only applied in the MI group. Sequestrotomy alone was performed in small or covered annular defects when the sequestered disc material exceeded the level of the intervertebral space toward cranial or caudal (5 FE, 3 MI). The patients in the FE group were mobilised directly after the procedure.
Follow-up	**24 months**
Conflict of interest/source of funding	None

Analysis

Follow-up issues:

- At day 1, 100% (100/00) of patients had a follow-up examination; at 3 months, 96% (96/100); at 6 months, 91% (91/100); at 12 months, 90% (90/100), and at 24 months, 87% (87/100).
- After 2 years, the 87% of patients still included in the study had been treated by the following procedures: 45 FE (24 IL, 21 TF) and 42 MI.
- The 13% (13/100) of patients who were missing 2 years after the procedure were lost for the following reasons: 1 patient moved away and left no forwarding address, 7 patients did not respond to letters or telephone calls, 3 patients were treated by revision surgery with conventional spinal canal decompression and 2 patients were treated by fusion.

Study design issues:

- The follow-up examinations were performed by 2 doctors who were not involved in the operations.
- Group allocation was open and made by non-physician study staff alternately to the FE or MI group in the sequence of presentation. The surgeon in each case selected the access within the FE group.
- All procedures were performed by 2 surgeons experienced in both techniques.

Study population issues:

- The duration of pain ranged from 1 day to 13 months (mean 69 days).
- 79% (79/100) of patients had received a mean of 9 weeks of conservative treatments.
- The mean time between the primary operation and revision was 19 months (2 to 82 months).
- 38 interventions were performed at the L5-S1 level (17 IL, 0 TF, 21 MI), 42 at L4-L5 (9 IL, 15 TF, 18 MI), 16 at L3-L4 (2 IL, 4 TF, 10 MI), and 4 at L2-L3 (1 IL, 2 TF, 1 MI).

Other issues: Clinical outcomes and patient satisfaction outcomes were given for the whole FE group and no distinction was made between IL and TF approaches. Therefore these data were not extracted from the paper.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **100 (50 FE discectomy [29 IL and 21 TF] versus 50 MI technique)**

Operative time (mean, range)

- FE group: 24 min (14-43min)
- MI group: 58 min (39-91 min)
- Significant difference between groups ($p < 0.001$)
- Within the FE group there was no significant difference between IL (18-43 min) and TF (14-33 min).

Blood loss (mean intra- and post-operative)

- FE group: no measurable blood loss
- MI group: 41 ml (10-205 ml).

Access-related osseous resection was needed in 6% of patients (3/50) in the FE group (1 IL, 2 TF) and in 94% (47/50) of patients in the MI group (significant difference between FE and MI groups, $p < 0.001$).

Extirpation of the intervertebral space was made 45 times in the FE group and 47 times in the MI group because the recurrence was at the level of the intervertebral space and there was an uncovered annulus defect.

Revisions

- FE group: 4% (2/50)
- MI group: 2% (1/50)
- 2 MI patients were treated by additional fusion because of progressive back pain.

Re-recurrences at 2-year follow-up

	IL group (n=24)	**TF group (n=21)**	**MI group (n=42)**
Recurrence rate	4% (1/24)	10% (2/21)	5% (2/42)

No significant differences between groups.

All patients with re-recurrence were treated a second time by the same technique as before.

Safety

Perioperative complications

Complication	**IL group (n=29)**	**TF group (n=21)**	**MI group (n=50)**
Dural injury	3% (1/29) It was glued.	0	6% (3/50)
Transient dysesthesia	6% (2/29)	0	10% (5/50)
Transient urinary retention	0	0	4% (2/50)
Delayed wound-healing	0	0	4% (2/50)
Soft tissue infection	0	0	2% (1/50)

Overall, the rates of serious complications were 6% in the FE group and 21% in the MI group, and were significantly higher in the MI group ($p < 0.05$).

Abbreviations used: FE, full-endoscopic; IL, interlaminar; MI, microsurgical; TF, transforaminal.

Study 3 Choi K-C (2013)

Details

Study type	**Retrospective comparative study**
Country	Korea
Recruitment period	2010
Study population and number	n=**60 (30 interlaminar PELD versus 30 transforaminal PELD)** consecutive patients with L5-S1 disc herniation.
Age and sex	Mean 35 years; 48% (29/60) male
Patient selection criteria	Inclusion criteria: unilateral radicular pain, single level intracanal disc herniation and failure of conservative treatment for more than 6 weeks. Exclusion criteria: definite congenital anomalies, including lumbarisation, spondylolysis, instability, foraminal or extraforaminal disc herniation and lateral recess stenosis.
Technique	• Interlaminar PELD: Provocative discography was performed before induction of general anaesthesia. An endoscope supplied by Wolf was used. Disc forceps were used to remove the protruded or sequestered disc pieces. • Transforaminal PELD: The procedure was performed under local anaesthesia. An epidurography and a discography were performed. If the spinal needle was on the medial pedicular line on anteroposterior view and not on the posterior vertebral line on lateral view, foraminoplasty was performed. An endoscope supplied by YESS system was used. Endoscopic forceps and a side-firing holmium:yttrium-aluminum-garnet (Ho:YAG) laser were used to remover the herniated disc and fibrotic scar tissues.
Follow-up	**Minimum 2 years**
Conflict of interest/source of funding	This study was supported by a grant from the Wooridul Spine Foundation. The authors reported no conflict of interest.

Analysis
Follow-up issues: Not reported.
Study design issues:
- The procedures were performed in 2 centres.
- Pre- and postoperative data were obtained from a chart review and a radiologic examination.
- An independent observer, other than the treating surgeons, performed the radiological assessments before the procedures.
- The herniation was defined as high-grade if the extent of migration was larger than the measured height of the posterior marginal disc space. Migration less than the measured height of the posterior marginal disc space was described as low-grade migration.

Study population issues:
- Significant differences between the interlaminar and the transforaminal groups were observed for the disc location, the disc type and the migration degree.
- Prevalence of axillary disc herniation (67% [20/30]) was higher than that of shoulder disc herniation (33% [10/30]) in the interlaminar group. However, in the transforaminal group, shoulder disc herniation (67%, [20/30]) was more prevalent than axillary disc herniation (33% [10/30]; p = 0.01).
- The prevalence of central disc herniation was significantly lower in the interlaminar group (7% [2/30]) than in the transforaminal group (33% [10/30], p = 0.01).
- 37% (11/30) of patients with high-grade migration were treated with interlaminar PELD and 1 patient (1/30) was treated with transforaminal PELD (p = 0.01). The discs were migrated upward or downward by up to 8 mm.

Other issues: Not reported.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **60 (30 interlaminar PELD versus 30 transforaminal PELD)**

Pain (VAS, mean ± SD)

	Interlaminar (n=30)	Transforaminal (n=30)	p value
VAS Back			
Before the procedure	5.5 ± 1.5	5.2 ± 2.0	NS
At the final follow-up (mean 2.2 years)	2.4 ± 1.0	2.4 ± 0.8	NS
VAS Leg			
Before the procedure	7.6 ± 1.4	7.4 ± 1.5	NS
At the final follow-up (mean 2.2 years)	1.7 ± 1.5	1.6 ± 1.0	NS

Significant improvements within groups in both groups.

Disability (ODI, %)

	Interlaminar (n=30)	Transforaminal (n=30)	p value
Before the procedure	51 ± 18	52 ± 16	NS
At the final follow-up (mean 2.2 years)	15 ± 9	12 ± 8	NS

Significant improvements within groups in both groups.

Operative failure

	Interlaminar (n=30)	Transforaminal (n=30)	p value
Complete removal of the disc fragment	93% (28/30)	97% (29/30)	NS
Incomplete removal of the disc fragment leading to conversion to open surgery	7% (2/30)	3% (1/30)	

Recurrence (%)

	Interlaminar (n=30)	Transforaminal (n=30)	p value
Recurrence rate	7% (2/30)	3% (1/30)	NS

Time to return to work (week)

	Interlaminar (n=30)	Transforaminal (n=30)	p value
Time to return to work	4.4 ± 1.7	4.9 ± 2.6	NS

Additional technique used

	Interlaminar (n=30)	Transforaminal (n=30)
Foraminoplasty		40% (12/30)
Medial facetectomy	17% (5/30)	

Safety

Dysesthesia was reported in 7% (2/30) of patients in the interlaminar group and in none of the patients in the transforaminal group.

Abbreviations used: NS, not significant; ODI, Oswestry disability index; PELD: percutaneous endoscopic lumbar discectomy; VAS, visual analogue scale.

Study 4 Yadav YR (2013)

Details

Study type	**Case series**
Country	India
Recruitment period	2006-2010
Study population and number	n=**400** consecutive patients with lumbar disc herniation
Age and sex	Mean 37 years; gender not reported
Patient selection criteria	Progressive neurologic deficit during observation and persistent bothersome sciatic pain despite conservative management for 12 weeks. Patients with single- and double-level disc with unilateral or bilateral symptoms including central, sequestrated, or migrated disc
Technique	The procedure was performed under general anaesthesia. The Destandu system (Karl Storz) was used. Minor dural punctures were treated by application of a medical absorbable gelatin sponge (AbGel, Shri Gopal Krishna Labs Pvt. Ltd) on the dura while significant dural tears were treated using fat and fibrin glue. After the procedure, patients were mobilised as soon as the pain decreased and were discharged 24 to 48 hours after the procedure.
Follow-up	**Mean 24 months**
Conflict of interest/source of funding	None reported

Analysis

Follow-up issues: Patients had a follow-up 2 weeks, 6 weeks, 3, 6 and 12 months after the procedure.
Study design issues:

- All procedures were performed by a single surgeon.
- Prospective study.

Study population issues:

- All patients, except 6 with severe pain not responding to conservative treatment, were given a trial of medical therapy for at least 12 weeks. All 6 patients had large disc herniation and were treated by surgery 3 to 5 days after the start of acute pain. Epidural or root block injection treatment and ozone treatment were also performed from other institutions in 20 and 40 patients, respectively, along with conservative management before surgery.
- In 18% (70/400) of patients, the procedure was performed at 2 levels.

Other issues: None.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **400**

Pain

	Before the procedure	3 months after the procedure
Mean VAS score	7.9	1.5

- VAS scores for back and leg pain improved significantly in 90% of patients when compared against scores before the procedure.

Recurrence

- 2 patients had recurrence and were treated again by surgery 3 and 6 months after the first procedure.

Conversion to open surgery

- Conversion to open surgery was reported in 1 patient who had root protrusion after dural tear in initial learning curve.

Patient's satisfaction

- Overall, 91% (364/400) of patients had good-to-excellent results according to MacNab criteria.
- Poor results were reported in 2% (8/400) of patients.
- Motor weakness was reported in 4% (17/400) of patients before the procedure and in all of them some recovery was reported at follow-up.

Blood loss

- Mean 20 mL per patient.

Safety

Complications

Complication	% patients	Detail
Accidental intraoperative single-facet injury	1% (3/400)	Occurred in the 3 first patients.
Minor dural tear	2% (7/400)	
Postoperative discitis	1% (2/400)	Both were treated conservatively.
Root injury and persistent paresthesia 2 years after the procedure	1 patient	

Most complications were seen in the initial 50 patients.

Abbreviations used: VAS, visual analogue scale.

Study 5 Ruetten S (2006)

Details

Study type	**Case series**
Country	Germany
Recruitment period	2001-2002
Study population and number	n=**372** patients with clinically symptomatic disc herniation
Age and sex	Mean 41 years; 45% (169/372) male
Patient selection criteria	Inclusion criteria: Disc herniations technical inoperable in transforaminal approach, an interlaminar window between the cranial and caudal lamina and between the middle line and mediodorsal border of the processus articularis inferior of at least 6 mm and maximal cranicaudal sequestering to half the adjacent vertebral body. Exclusion criteria: general surgical contraindications.
Technique	Full-endoscopic technique with interlaminar access. All the operating instruments and optics were supplied by Wolf. Bipolar probes manufactured by Ellman and Select were also used.
Follow-up	**2 years**
Conflict of interest/source of funding	Not reported

Analysis

Follow-up issues:

- Initially, 423 patients were treated by percutaneous interlaminar endoscopic discectomy but 51 patients were excluded because they did not speak German. From the study population of 372 patients, 89% (331/372) were included in follow-up. The reasons for the exclusion of the remaining patients were: 2 procedure-unrelated deaths, 9 patients moved away and left no forwarding address and 30 patients did not respond to letters of phone calls.
- Follow-up examinations were made at day 1 and at 3, 6, 12 and 24 months after the procedure.

Study design issues:

- General anaesthesia was administered 366 times and local anaesthesia 6 times.

Study population issues:

- The duration of pain ranged from 1 day to 16 months (mean 87 days).
- 54% (202/372) of patients presented with neurological deficits, 7% (26/372) had bilateral symptoms, 1% (5/372) contralateral and 2% (6/372) a cauda equina syndrome caused by disc prolapse.
- 6% (22/372) of patients had been treated by previous microscope-assisted surgery at the same level and 5% (20/372) at the same level.
- 79% (293/372) had received a mean of 10 weeks conservative treatment and 21% (79/372) were treated immediately.
- 249 interventions were performed at level L5/S1, 107 at L4/5, 14 at L3/4 and 2 at L2/3.
- 96% (358/372) of patients were treated on 1 side and 4% (14/372) on both sides.

Other issues: None.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **372 included in the study population but only 331 had a 2-year follow-up**

Recurrence

- 2% (8/331) of patients had a recurrence within 6 months after the procedure.
- 1 patient suffered another recurrence.

Pain and disability (Mean VAS, ODI and NASS scores reported for 93% [309/331] of non-revised patients)

	Before the procedure	3 months	6 months	12 months	24 months
VAS leg	74	10	9	8	7
VAS back	21	21	18	22	23
ODI	79	24	20	22	21
NASS pain	4.5	2.3	2.5	2.1	2.2
NASS neurology	3	2.1	2.2	1.9	2.1

NASS scale scores range from 1 to 6 (best to worst).

- 82% (254/309) of patients no longer had leg pain, 13% (40/309) had pain occasionally or the pain was greatly reduced and 5% (15/309) had no essential improvement.
- From the 15 patients who reported no essential improvement, 33% (5) were previously treated at the same level and 67% (10) had compression by hard tissue.
- Neurological deficits were significantly better reduced with a history of less than 6 days (p=0.013).

Patient satisfaction

- 91% (301/331) of patients reported subjective satisfaction and would undergo the procedure again.
- 9% (29/331) had a poor result in the sense of no reduction in leg pain or had to be treated by open surgery later.

Activity

- 98% (247/251) of patients who were not unemployed or retired returned to their occupation or sports activities.
- 2% (4/251) of patients who were not unemployed or retired were not able to return to their occupation because of persistent pareses.
- Sick leave following hospitalisation ranged from 5 to 33 days (mean 16 days).

Safety

- 3 patients developed a transient postoperative **dysaesthesia.**

Abbreviations used: NASS, North American spine society instrument; ODI, Oswestry disability index; VAS, visual analogue scale.

Study 6 Kang SH (2011)

Details

Study type	**Case series**
Country	Korea
Recruitment period	2003-2008
Study population and number	n=**1406 patients (1503 cases [298 IL, 1205 TF])** with protruded or extruded disc materials compressing the lumbar root(s)
Age and sex	Mean 23 years; 100% (1503/1503) male
Patient selection criteria	Consecutive patients with protruded or extruded disc materials compressing the lumbar root(s).
Technique	The endoscopic discectomies were performed using the Vertebris® system (Richard Wolf). Interlaminar endoscopic discectomy was performed in L5/S1 level. Transforaminal endoscopic discectomy was performed in all other cases and some limited L5/S1 cases. Most patients received intraoperative epidural steroids at the end of their surgeries.
Follow-up	**Mean 25 months**
Conflict of interest/source of funding	Not reported

Analysis

Follow-up issues: All patients received postoperative magnetic resonance imaging scans (MRIs) within 7 days after surgery. When new symptoms occurred, follow-up MRIs were checked.

Study design issues:

- A 23-member board of neurosurgeons performed the 1503 procedures.
- Radiologically, cystic lesion of T2W high and T1W low signal intensity at discectomy site were regarded as post-discectomy pseudocyst (PP).
- PP patients were divided into 2 groups according to the treatment modality after PP detection, surgically treated and conservatively treated.

Study population issues:

- All patients were soldiers at the time of their procedures.

Other issues:

- No distinctions were made between the IL and TF groups for the clinical outcomes.

Key efficacy and safety findings

Efficacy	Safety
Number of patients analysed: n=**1406 patients (1503 cases [298 IL, 1205 TF])** No distinction was made between the IL and TF groups for the clinical outcomes so the results were not reported.	Symptomatic post-discectomy **pseudocysts**: • IL: 3% (9/298) • TF: 1% (6/1205) Significant difference between groups (p=0.001). The interval between discectomy and pseudocyst detection via MRI was mean 53.7 (11-118) days. 5 pseudocysts were treated surgically and 10 were treated conservatively but the paper did not mention the original procedure for these.
Abbreviations used: FE, full-endoscopic; IL, interlaminar; MRI, magnetic resonance imaging; PP, post-discectomy pseudocyst; TF, transforaminal.	

Study 7 Kim HS (2013)

Details

Study type	**Retrospective comparative study**
Country	South Korea
Recruitment period	2008-2010
Study population and number	n= **224 (91 percutaneous endoscopic interlaminar lumbar discectomy [PEID] with annular sealing versus 133 PEID without annular sealing)** consecutive patients with radiculopathy because of L5-S1 disc herniation
Age and sex	Mean 41.5 years; 61% (137/224) male
Patient selection criteria	Inclusion criteria: unilateral radicular pain in the leg that did not respond to 8 weeks of conservative treatments and imaging which suggested posterolateral ruptured disc herniation at the L5-S1 level that corresponded with the clinical symptoms. Exclusion criteria: patients who needed extensive discectomy, patients who had been previously treated by surgery at the same vertebral level, and patients with less than 1 year of follow-up data after the procedure.
Technique	Only sequestrectomy or fragmentectomy were performed (no extensive discectomy) in both groups. A dissector was used in both groups to open the annulus. In the group without annular sealing, the cannula and scope were removed after extracting the ruptured particles. In the group with annular sealing, the circumference of the annular fissure was subsequently coagulated using bipolar radiofrequency (Ellman Corp.) toward the annular defect. Radiofrequency was adjusted to 15 watts and coagulation duration was timed to less than 1 second per coagulation.
Follow-up	**Mean 19.5 months**
Conflict of interest/source of funding	None

Analysis
Follow-up issues: None.
Study design issues:
- All procedures were performed randomly.
- Recurrence was defined as disc herniation on the same side and level as the primary operative site after successful initial removal of the protruding disc and a pain-free interval after surgery (reported on an immediate MRI after the procedure). Early recurrence was defined as recurrence within 6 months after the procedure and late recurrence as recurrence at more than 6 months after the procedure.
- The procedures were performed by 2 surgeons both experienced in the technique.

Study population issues: No differences in indications between groups were reported.
Other issues: None.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **224 (91 PEID with annular sealing versus 133 PEID without annular sealing)**

Pain (mean VAS score ± SD)

Operative technique	VAS before the procedure (leg)	VAS at the final follow-up (leg, mean 19.5 months)
Total (n=224)	7.8±0.6	2.0±0.8
PEID with sealing (n=91)	7.7±0.6	1.9±0.8
PEID without sealing (n=133)	7.9±0.6	2.0±0.8

Disability (mean ODI score)

Operative technique	ODI before the procedure (leg)	ODI at the final follow-up (mean 19.5 months)
Total (n=224)	55.6±7.4	18.8±3.2
PEID with sealing (n=91)	54.8±8.6	18.4±3.8
PEID without sealing (n=133)	55.4±9.2	19.2±3.2

Recurrence

Operative technique	Total recurrence	Early recurrence (≤ 6months)	Late recurrence
Total (n=224)	10% (23/224)	7% (15/224)	4% (8/224)
PEID with sealing (n=91)	6% (5/91)	2% (2/91)*	3% (3/91)
PEID without sealing (n=133)	14% (18/133)	10% (13/133)*	4% (5/133)

***Significant difference between groups (p=0.029).
Spearman correlation coefficients for correlations according to operative technique (Spearman's rs=0.191, p=0.004).

- Early recurrence occurred at mean 1.6 months after the procedure.
- Late recurrence occurred at mean 17.1 months after the procedure.
- Increasing age was correlated with higher overall recurrence (Spearman's rs=0.157, p=0.008) and late recurrence (Spearman's rs=0.176, p=0.026).
- In the 10% (23/224) of patients who experienced recurrence, 39% (9/23) were subsequently treated by microdiscectomy, 48% (11/23) by repeat PEID and 13% (3/23) by conservative treatment.

Safety

There was no reporting of adverse events.

Abbreviations used: MRI, magnetic resonance imaging; ODI, Oswestry disability index; PEID, percutaneous endoscopic interlaminar lumbar discectomy; VAS, visual analogue scale

Study 8 Sencer A (2014)

Details

Study type	Case series
Country	Turkey
Recruitment period	2009-2012
Study population and number	n= **163 (104 interlaminar and 71 transforaminal procedures)** consecutive patients with lumbar disc herniations.
Age and sex	Mean 47 years; 45% (74/163) male
Patient selection criteria	Patients with ongoing symptoms of back and leg pain, presence of any progressive neurologic deficit or radicular pain that was unresponsive to medical therapy. The interlaminar approach was only used in patients with the following characteristics: sequestering material had migrated beyond the lower edge of the cranial pedicle or over the middle of the caudal pedicle and the foramen was overlaid by the iliac crest on lateral plain X-rays.
Technique	Both procedures were performed under general anaesthesia. If no complications occurred, patients were mobilised 3 hours after the procedure and discharged from the hospital the following day.
Follow-up	**12 months**
Conflict of interest/source of funding	Not reported

Analysis

Follow-up issues: Follow-up was arranged 3 weeks, 3, 6, 9 and 12 months after the procedure.

Study design issues: Clinical outcomes of pain and disability, as well as patient satisfaction were not reported separately for the 2 techniques.

Study population issues:

- For the interlaminar approach, 47% (49/104) of procedures were performed in patients with a herniated disc at the L5-S1 level, 47% (49/104) at L4-5, 3% (3/104) at L3-4 and 3% (3/104) at L2-3.
- Multilevel lumbar discectomy was performed in 7% (11/163) of patients and single-level discectomy in 93% (152/163). In 1 patient, 3-level discectomy was performed and 2-level discectomy was performed in 10 patients.
- In 11 patients with single-level disc herniations, there was a history of previous microdiscectomy at the same level and the same side. The interlaminar approach was used in 64% (7/11) of these patients.

Other issues: The institution where the study was conducted had no prior experience with either IL or TF approaches.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **163 (104 interlaminar and 71 transforaminal procedures)**

Recurrence

- 4% (4/104) for the interlaminar approach

On 3 occasions the patients were treated by a second interlaminar procedure (pain symptoms only improved for 1 patient) and on 1 occasion, the patient was treated by microdiscectomy (patient reported an improvement in pain symptoms).

- 3% (2/71) for the transforaminal approach

One patient was treated by a second transforaminal procedure and the other patient was treated by microdiscectomy. Pain symptoms improved for both patients.

Treatment failure

Early pain relief did not occur in 2 patients who were treated by the transforaminal approach because of residual herniated disc material. These patients were reoperated with the same technique.

Summary of reoperations

Patient number	Etiology	Levels	First operation	Time between operations	Second operation	Outcome
1	Recurrence	L5-S1	TF	3 months	MD	Better
2	Residual	L4-5	TF	1 month	TF	Better
3	Recurrence	L4-5	IL	2 months	IL	Same
4	Recurrence	L5-S1	IL	1 week	IL	Better
5	Recurrence	L5-S1	IL	1 month	IL	Same
6	Recurrence	L3-4	TF	2 months	TF	Better
7	Recurrence	L5-S1	IL	2 weeks	MD	Better
8	Residual	L4-5	TF	1 week	TF	Same

Authors stated that 'no further recurrences occurred after the second surgery.'

Conversion to conventional microdiscectomy

No conversion was needed during the procedure for either approach.

VAS and ODI scores were not reported separately for the IL and the TF approaches.

Safety

Complications (n=163 patients)

Complication	% procedures with the interlaminar approach (n=104)	% procedures with the transforaminal approach (n=71)	Detail
Motor deficits	3% (5/163)		In 2 of these patients, 2-level discectomy was performed using an interlaminar approach for 1 level and a transforaminal approach for 1 level. In 4 patients these motor deficits were transient and complete recovery occurred, including the 2 patients who were treated by 2-level discectomies. In 1 patient there was a permanent motor deficit resulting in foot drop.
Dysesthesia	0% (0/104)	6% (4/71)	In 3 patients it resolved completely. In 1 patient limited relief was achieved with epidural and foraminal steroid injections.
Dural tear	6% (6/104)	0% (0/71)	There was no attempt at dural repair in 5 patients. These patients were followed in the clinic with 2 additional days of bed rest and thereafter were mobilised and discharged.
Open cerebrospinal fluid fistula	1/104	0% (0/71)	This complication occurred in 1 of the 6 patients who had a dural tear. The surgeons attempted to repair the dura using an open microsurgical technique immediately after completing the procedure. The patient had to be treated by a 2nd surgery for dural repair and the fistula was treated by 5 days of bed rest and lumbar drainage.
Superficial wound infection	1% (2/175)		The paper did not specify the type of procedure received by the patients who experienced these complications. They were treated by oral antibiotics.

Abbreviations used: IL, interlaminar; MD, microdiscectomy; TF, transforaminal.

Efficacy

Symptom improvement (back and leg pain)

A retrospective study of 60 patients comparing interlaminar endoscopic lumbar discectomy (n=30) against transforaminal endoscopic lumbar discectomy (n=30) reported a significant improvement in mean visual analogue scale (VAS) scores (ranging from 0 to 10 from best to worst), in both groups, for leg and back pain from before the procedure to a mean follow-up of 2.2 years. In the interlaminar group, back pain scores changed from 5.5 to 2.4 and leg pain scores changed from 7.6 to 1.7 (level of significance not reported). In the transforaminal group, back pain scores changed from 5.2 to 2.4 and leg pain scores changed from 7.4 to 1.6 (level of significance not reported). There was no significant difference between the interlaminar and transforaminal groups[3].

A case series of 400 patients treated by interlaminar endoscopic lumbar discectomy reported an improvement in mean VAS scores for back and leg pain from 7.9 before the procedure to 1.5 at 3 months after the procedure; it also reported that the VAS scores improved significantly in 90% of patients when compared against scores before the procedure[4].

A case series of 372 patients treated by percutaneous endoscopic interlaminar discectomy (PEID) reported a decrease in mean VAS scores for leg pain from 74% before the procedure to 7% at 2-year follow-up in the 331 patients who had a follow-up at 2 years. Mean VAS scores for back pain were 21% before the procedure and 23% at 2 years. The same study reported mean North American spine society (NASS) pain scores (range from 1 to 6, from best to worst) of 4.5 before the procedure and 2.2 at 2 years[5].

A retrospective study of 224 patients comparing PEID with annular sealing (n=91) against PEID without annular sealing (n=133) reported total mean VAS scores for leg pain of 7.8 before the procedure and 2.0 at mean 19.5 months of follow-up[7].

Improvement in disability score

The retrospective comparative study of 60 patients reported significant improvements in mean Oswestry Disability Index (ODI) scores (ranging from 0 to 100, from no disability to maximum disability) from before the procedure to a mean follow-up of 2.2 years; from 51% to 15% in the interlaminar group, and from 52% to 12% in the transforaminal group (no significant difference between groups)[3].

The case series of 372 patients treated by percutaneous interlaminar endoscopic discectomy reported improvement in mean ODI score from 79% before the procedure to 21% at 2 years after the procedure (level of significance not stated). The same study reported mean NASS neurology scores (ranging from 1 to 6,

from best to worst) of 3 before the procedure and 2 at 2 years after the procedure (level of significance not stated)[5].

The retrospective study of 224 patients comparing PEID with annular sealing against PEID without annular sealing reported total mean ODI scores of 55.6 before the procedure and 18.8 at mean 19.5 months of follow-up[7].

Recurrence

A prospective comparative study of 200 patients with disc herniation treated by full-endoscopic discectomy (interlaminar approach, n=59; transforaminal approach, n=41) or microsurgical discectomy (n=100) reported recurrence rates at 2-year follow-up of 6% (3/53) in the interlaminar group, 8% (3/38) in the transforaminal group and 6% (5/87) in the microsurgical group (no significant difference between groups). All patients with recurrence were treated a second time by the same technique; in the transforaminal group, 2 patients had another recurrence[1].

A prospective comparative study of 100 patients with recurrent lumbar disc herniation treated by full-endoscopic discectomy (interlaminar approach, n=29; transforaminal approach, n=21) or microsurgical discectomy (n=50) reported re-recurrence rates at 2-year follow-up of 4% (1/24) in the interlaminar group, 10% (2/21) in the transforaminal group and 5% (2/42) in the microsurgical group (no significant difference between groups). All patients with re-recurrence were treated a second time by the same technique[2].

The retrospective comparative study of 60 patients reported recurrence in 7% (2/30) of patients treated by the interlaminar approach and in 3% (1/30) of patients treated by the transforaminal approach within a minimum of 2 years after the procedure (no significant difference between groups) [3].

The case series of 400 patients reported recurrence in 2 patients; they were treated again by surgery at 3 and 6 months after the first procedure[4].

The case series of 372 patients reported recurrence within 6 months after the procedure in 2% (8/331) of patients with a 2-year follow-up; 1 patient had another recurrence (no further details provided)[5].

The retrospective study of 224 patients comparing PEID with annular sealing against PEID without annular sealing reported recurrence in 10% (23/224) of patients; early recurrence (within 6 months after the procedure) was reported in 7% (15/224) of patients and late recurrence in 4% (8/224) of patients. Early recurrence occurred at mean 1.6 months after the procedure and late recurrence occurred at mean 17.1 months after the procedure. Patients who had recurrence were treated by microdiscectomy (9/23), repeat PEID (11/23) or conservative treatment (3/23)[7].

A case series of 163 patients (175 procedures) with lumbar disc herniations treated by interlaminar (n=104) or transforaminal (n=71) endoscopic lumbar discectomy reported recurrence in 4% (4/104) of the interlaminar procedures and in 3% (2/71) of the transforaminal procedures; in 3 occasions the patients were treated by a second interlaminar procedure (pain symptoms only improved for 1 patient) and in 1 occasion, the patient was treated by microdiscectomy (patient reported an improvement in pain symptoms)[8].

Conversion to open surgery

The case series of 400 patients reported conversion to open surgery in 1 patient who had root protrusion after sustaining a dural tear during the procedure; the authors stated that this happened during the period when the surgeons were gaining experience in how to do the procedure[4].

The case series of 163 patients (175 procedures) with lumbar disc herniations treated by interlaminar (n=104) or transforaminal (n=71) endoscopic lumbar discectomy reported no conversion to open surgery for either approach[8].

Operative success

The retrospective comparative study of 60 patients reported complete removal of the disc fragment in 93% (28/30) of patients treated by the interlaminar approach and in 97% (29/30) of patients treated by the transforaminal approach (no significant difference between groups) [3].

Return to work

The retrospective study of 60 patients reported that the mean time to return to work was 4.4 weeks for patients treated by the interlaminar approach and 4.9 weeks for patients treated by the transforaminal approach (no significant difference between groups)[3].

The case series of 372 patients reported that 98% (247/251) of patients who were not unemployed or retired returned to their occupation or sport activities; 2% (4/251) were not able to return to their occupation because of persistent paresis. Sick leave following hospitalisation ranged from 5 to 33 days (mean 16 days)[5].

Patient satisfaction

The case series of 400 patients reported good-to-excellent results according to MacNab criteria in 91% (364/400) of patients; poor results were reported in 2% (8/400) of patients (no further details reported)[4].

The case series of 372 patients reported that 91% (301/331) of patients reported subjective satisfaction up to 2 years after the procedure and would have the

procedure again; 9% (29/331) had a poor result (defined as no reduction in leg pain or having to be retreated by open surgery)[5].

Safety

Facet injury

Single-facet injury during the procedure was reported in the first 3 patients in a case series of 400 patients with lumbar disc herniation treated by percutaneous interlaminar endoscopic lumbar discectomy (no further details provided)[4].

Dural injury

Dural injury was reported in 1 patient who had recurrent lumbar disc herniation after conventional discectomy, treated by interlaminar endoscopic lumbar discectomy in a prospective comparative study of 100 patients treated by full-endoscopic discectomy (interlaminar approach, n=29; transforaminal approach, n=21) or microsurgical discectomy (n=50); it was repaired with fibrin glue. Dural injury was reported in none of the patients in the transforaminal group and in 6% (3/50) of patients in the microsurgical group (no further details provided)[2].

Minor dural tear was reported in 2% (7/400) of patients in the case series of 400 patients (no further details provided)[4].

Dural tear was reported in 6% (6/104) of procedures using the interlaminar approach in a case series of 163 patients (175 procedures) with lumbar disc herniations treated by interlaminar or transforaminal endoscopic lumbar discectomy. In 5 procedures, patients were treated conservatively with 2 additional days of bed rest before mobilisation and discharge. In 1 procedure, an attempt was made to repair the dura by open surgery immediately after the procedure; this was complicated by an open cerebrospinal fluid fistula. The patient needed a second procedure to repair the dura and 5 days of bed rest and lumbar drainage[8].

Nerve root injury

Nerve root injury and persistent paraesthesia 2 years after the procedure were reported in 1 patient in the case series of 400 patients (no further details provided)[4].

Motor deficit

Motor deficit was reported in 3% (5/163) of patients (interlaminar approach, n=104 procedures; transforaminal approach, n=71 procedures) in the case series of 163 patients. In 2 of these 5 patients, 2-level discectomy was performed using an interlaminar approach for 1 level and a transforaminal approach for 1 level. In 4 patients these motor deficits were transient and they recovered completely,

including the 2 patients who were treated by 2-level discectomies. In 1 patient there was a permanent motor deficit resulting in foot drop (no further details provided)[8].

Dysaesthesia

Transient dysaesthesia was reported in 3% (2/59) of patients with symptomatic lumbar disc herniation treated by interlaminar endoscopic lumbar discectomy in a prospective comparative study of 200 patients treated by full-endoscopic discectomy (interlaminar approach, n=59; transforaminal approach, n=41) or microsurgical discectomy (n=100). In the transforaminal group and in the microsurgical group, transient dysaesthesia was reported in 2% (1/41) and 5% (5/100) respectively (no further details provided)[1].

Transient dysaesthesia was reported in 6% (2/29) of patients who had recurrent lumbar disc herniation after conventional discectomy, treated by interlaminar endoscopic lumbar discectomy, in the prospective comparative study of 100 patients treated by full-endoscopic discectomy or microsurgical discectomy; it was reported in none of the patients in the transforaminal group and in 10% (5/50) in the microsurgical group (no further details provided)[2].

Dysaesthesia was reported in 7% (2/30) of patients with symptomatic lumbar disc herniation treated by interlaminar endoscopic lumbar discectomy and in none of the 30 patients treated by the transforaminal approach in a retrospective comparative study of 60 patients (no further details provided)[3].

Transient dysaesthesia was reported in 3 patients treated by interlaminar endoscopic lumbar discectomy in a case series of 372 patients with symptomatic lumbar disc herniation (no further details provided)[5].

Discitis

Discitis was reported in 1% (2/400) of patients after the procedure in the case series of 400 patients; both patients were treated conservatively (no further details provided)[4].

Pseudocyst

Pseudocysts were reported in 3% (9/298) of procedures in the group of patients treated by interlaminar endoscopic lumbar discectomy and in 1% (6/1205) of procedures in the group of patients treated by the transforaminal approach in a case series of 1406 patients with protruded or extruded disc materials compressing the lumbar root (p=0.001 for the comparison between groups). The interval between discectomy and pseudocyst detection on MRI was a mean of 53.7 (11–118) days. Five pseudocysts were treated surgically and 10 were treated conservatively[6].

Validity and generalisability of the studies

- Three[1,2,5] of the studies included in table 2 were from the same main author but they do not seem to have overlaps.
- Two randomised controlled trials (RCTs)[1,2] are included in table 2, 1 including patients with lumbar disc herniation and 1 including patients with recurrent lumbar disc herniation who had already been treated by conventional discectomies.
- All studies included patients with lumbar disc herniation, only 1[7] specified that patients had a radiculopathy.
- Follow-up was almost always 2 years.
- Some of the studies did not make a distinction between the interlaminar and the transforaminal approaches when reporting certain outcomes. Therefore the data could not be extracted.
- In some studies, surgeons had no prior experience with the interlaminar technique.
- Studies about the translaminar approach were excluded.

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B gives details of the recommendations made in each piece of guidance listed.

Interventional procedures

- Insertion of an annular disc implant lumbar discectomy. NICE interventional procedure guidance 506 (2014). Available from: https://www.nice.org.uk/guidance/ipg506

- Percutaneous intradiscal laser ablation in the lumbar spine. NICE interventional procedure guidance 357 (2010). Available from: https://www.nice.org.uk/guidance/ipg357

- Percutaneous intradiscal electrothermal therapy for low back pain. NICE interventional procedure guidance 319 (2009). This guidance is currently under review and is expected to be updated in 2015. For more information, see: https://www.nice.org.uk/guidance/ipg319

- Prosthetic intervertebral disc replacement in the lumbar spine. NICE interventional procedure guidance 306 (2009). Available from: https://www.nice.org.uk/guidance/ipg306

- Percutaneous endoscopic laser lumbar discectomy. NICE interventional procedure guidance 300 (2009). This guidance is currently under review and is expected to be updated in 2015. For more information, see: https://www.nice.org.uk/guidance/ipg300

- Percutaneous disc decompression using coblation for low back pain NICE interventional procedure guidance 173 (2006). This guidance is currently under review and is expected to be updated in 2015. For more information, see: https://www.nice.org.uk/guidance/ipg173

- Automated percutaneous mechanical lumbar discectomy. NICE interventional procedure guidance 141 (2005). Available from: https://www.nice.org.uk/guidance/ipg141

- Percutaneous intradiscal radiofrequency thermocoagulation for lower back pain. NICE interventional procedure guidance 83 (2004). This guidance is currently under review and is expected to be updated in 2015. For more information, see: http://www.nice.org.uk/guidance/ipg83

- Percutaneous endoscopic laser thoracic discectomy. NICE interventional procedure guidance 61 (2004) Available from: https://www.nice.org.uk/guidance/ipg61

- Endoscopic laser foraminoplasty. NICE interventional procedure guidance 31 (2003). Available from: https://www.nice.org.uk/guidance/ipg31

NICE guidelines

- Low back pain in adults: early management. NICE clinical guideline 88 (2009). This guidance is currently under review and is expected to be updated in 2016. For more information, see: https://www.nice.org.uk/guidance/cg88

Specialist advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and is not intended to represent the view of the society. The advice provided by Specialist Advisers, in the form of the completed questionnaires, is normally published in full on the NICE website during public consultation, except in circumstances but not limited to, where comments are considered voluminous, or publication would be unlawful or inappropriate. Four Specialist Advisor Questionnaires for percutaneous interlaminar endoscopic lumbar discectomy for sciatica were submitted and can be found on the NICE website.

Patient commentators' opinions

NICE's Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

- No ongoing trials.

References

1. Ruetten S, Komp M, Merk H et al. (2008) Full-endoscopic interlaminar and transforaminal lumbar discectomy versus conventional microsurgical technique: a prospective, randomized, controlled study. Spine 33:931-939.
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7. Kim HS and Park JY. (2013) Comparative assessment of different percutaneous endoscopic interlaminar lumbar discectomy (PEID) techniques. Pain Physician 16:359-367.
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Appendix A: Additional papers on percutaneous interlaminar endoscopic lumbar discectomy for sciatica

The following table outlines the studies that are considered potentially relevant to the IP overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Chen HT, Tsai CH, Chao SC et al. (2011) Endoscopic discectomy of L5-S1 disc herniation via an interlaminar approach: Prospective controlled study under local and general anesthesia. Surgical neurology international 2:93-	Non-randomised comparative study n=123 Follow-up=12 months	VAS scores for back pain and leg pain and ODI revealed statistically significant improvement when they were compared with preoperative values. Mean hospital stay was statistically shorter in the local anaesthesia group. Complications included one case of dural tear with rootlet injury and three cases of recurrence within 1 month who subsequently required open surgery or endoscopic interlaminar lumbar discectomy. There were no medical or infectious complications in either group.	Comparison of interlaminar endoscopic approach performed under local or general anaesthesia. No new complications reported.
Choi G, Lee SH, Raiturker PP et al. (2006) Percutaneous endoscopic interlaminar discectomy for intracanalicular disc herniations at L5-S1 using a rigid working channel endoscope. Neurosurgery 58:Suppl-68.	Case series n=4 Follow-up=2 years	All 4 patients experienced improvement in their preoperative symptoms and signs immediately postoperatively. The mean VAS scores for back and leg pain improved from 3.75 to 1.75 and from 8.5 to 0.75, respectively. The mean ODI score improved from 65% to 3%. Postoperative MR imaging also depicted L5 root decompression. There were no complications during the procedure.	Larger case series already included in Table 2.
Choi G, Prada N, Modi HN et al. (2010) Percutaneous endoscopic lumbar herniectomy for high-grade down-migrated L4-L5 disc through an L5-S1 interlaminar approach: a technical note. Minimally Invasive Neurosurgery 53:147-152.	Case series n=67 Follow-up=18 months	VAS for leg pain (preoperative mean, 7.89; postoperative mean, 1.58) and ODI (preoperative mean, 57.43; postoperative mean, 11.52) showed statistically significant improvement in their values at the last follow-up examination compared against preoperative scores. Of the study group, 91% individuals showed favorable result. The mean hospital stay was 12 hours. The average time to return to work was 6.79 weeks. Complications included two cases of dural injury with cerebrospinal fluid leakage, nine cases of dysesthesia that were transient, and one case of recurrence. Two patients required conversion to open procedure at the initial operation. There was no evidence of infection in any patients.	Larger case series already included in Table 2.
Chumnanvej S, Kesornsak W, Sarnvivad P et al. (2011) Full endoscopic lumbar discectomy via interlaminar approach: 2-year results in Ramathibodi Hospital.[Erratum appears in J Med Assoc Thai. 2012	Case series n=60 Follow-up=26 months	Full-endoscopic lumbar discectomy is a safe and effective procedure for lumbar disc herniation. Patients can expect less postoperative pain, early recovery, and a short period of work absence. However, the learning curve is steep. Proper surgical training and careful patient selection in the early cases are the keys to success.	Larger case series already included in Table 2.

Feb;95(2):296 Note: Paiboonsirijit, Sompoch [added]]. Journal of the Medical Association of Thailand 94:1465-1470.			
Hsu H-T and Yang SS. (2013) Full-endoscopic interlaminar discectomy for herniation at L3e4 and L4e5: Technical note. Formosan Journal of Surgery.46 (3) 90-96.	Case reports n=3 Follow-up=Not reported	To achieve a good outcome, a beginner should first master open microscopic lumbar discectomy and then start with observing procedures, assisting at procedures, and practicing FEILD on cadavers.	Larger case series already included in Table 2.
Jasper GP, Francisco GM et al (2014). Outpatient, awake, ultra-minimally invasive endoscopic treatment of lumbar disc herniations. Rhode Island Medical Journal. June, 47-49.	Comparative case series n=41 (17 interlaminar versus 24 transforaminal) Follow-up: 1 year	The average pain relief at 1- year was 75% for IL group and 76% for TF group, both excellent results defined by MacNab. The average 1 year VAS scores reduced from 8.4 to 2.1 in IL group and from 8.2 to 1.7 in TF group . There were no complications.	Larger and longer follow-up studies included in table 2.
Kim CH and Chung CK. (2012) Endoscopic interlaminar lumbar discectomy with splitting of the ligament flavum under visual control. Journal of Spinal Disorders & Techniques 25:210-217.	Case series (retrospective) n=26 (15 Interlaminar 15) Follow-up: 19 months	In all recurrent disk material was removed successfully, postoperative MRI confirmed this, An excellent to good outcome (by MacNab's criteria) was achieved in 81% (n=21) patients.re-recurrence occurred in 2 patients at 6 and 12 months postoperatively.	Results not reported separately for transforaminal and interlaminar approach.
Kim CH, Chung CK, Jahng TA et al. (2012) Surgical outcome of percutaneous endoscopic interlaminar lumbar diskectomy for recurrent disk herniation after open diskectomy. Journal of Spinal Disorders & Techniques 25:E125-E133.	Case series n=10 Follow-up=12 months	In all 10 patients, the reherniated disk materials were removed successfully. There was no incidence of dural tear. Good decompression with thecal sac reexpansion irrespective of the attached scar tissue reported, except in 1 patient. Excellent or good outcome by Macnab criteria was obtained in 6 of 10 patients, fair outcome in 2, and poor in 2 patients. Rerecurrence occurred in 1 patient 1 year after the surgery	Larger case series already included in Table 2.
Kim CH, Chung CK, and Woo JW. (2012) Surgical Outcome of Percutaneous Endoscopic Interlaminar Lumbar Discectomy for Highly Migrated Disc Herniation. J.Spinal Disord Tech.	Case series n=18 (17 interlaminar) Follow-up=16 months	Complete removal of the disc material in 16 patients (success rate 89%). Revision operation was necessary in 2 patients. The outcome at the last follow-up was excellent in 12 patients, good in 3, fair in 2 and poor in 1. Dural tear was suspected in 1 patient and there was no recurrence during follow-up.	Larger case series already included in Table 2.
Kim CH, Chung CK, Sohn S et al. (2014) The surgical outcome and the surgical strategy of percutaneous endoscopic discectomy for recurrent disk herniation. Journal of Spinal Disorders &	Case series n=30 Follow-up=149 days	The ligament flavum (LF) could be safely split under direct visualization using a working channel with a minimal resulting defect. This technique of LF splitting endoscopic discectomy is a feasible approach, even for migrated disc herniation	Larger case series with longer follow-up already included in Table 2.

Techniques 27:415-422.			
Koga S, Sairyo K, Shibuya I et al. (2012) Minimally invasive removal of a recurrent lumbar herniated nucleus pulposus by the small incised microendoscopic discectomy interlaminar approach. Asian Journal of Endoscopic Surgery 5:34-37.	Case reports n=2 Follow-up=Not reported	In the near future, percutaneous endoscopic surgery could be the gold standard for minimally invasive disc surgery.	Larger case series already included in Table 2.
Kuonsongtum V, Paiboonsirijit S, Kesornsak W et al. (2009) Result of full endoscopic uniportal lumbar discectomy: preliminary report. Journal of the Medical Association of Thailand 92:776-780.	Case series n=46 (34 interlaminar, 12 transformainal) Full endoscopic uniportal lumbar discectomy. Follow-up: postoperative	Excellent and good outcome was achieved in 87.4% of patients from Modified McNab criteria. Forty-three patients (93.5%) had significant improvement of sciatic pain immediately after the operation. Eight postoperative complications were demonstrated and discussed.	Results not reported separately for transforaminal and interlaminar approach.
Li Z-Z, Hou S-X, Shang W-L et al. (2015) The strategy and early clinical outcome of full-endoscopic L5/S1 discectomy through interlaminar approach. Clinical Neurology and Neurosurgery.133 (40-45).	Case series n=72 Follow-up=12 months	No conversion to other surgical techniques reported. Only 1 reoccurrence was revised with microendoscopic discectomy. No nerve injury and infection were complicated. Postoperative ODI and VAS of low back pain and sciatica were significantly decreased in each time point ($P < 0.05$). MacNab scores of 12-month follow-up include 44 excellent, 26 good, 1 fair and 1 poor.	Larger case series with longer follow-up already included in Table 2.
Pal D and Tyagi AK. (2006) Interlaminar approach for excision of lateral lumbar disc herniation: technical note. Spine 31:E114-E116.	Case report n=1 Follow-up=1 year	The patient underwent a left L4/5 discectomy and removal of the lateral disc via the interlaminar approach from the contralateral (right) side with excellent postoperative result.	Larger case series with longer follow-up already included in Table 2.
Postacchini F, Cinotti G, and Gumina S. (1998) Microsurgical excision of lateral lumbar disc herniation through an interlaminar approach. Journal of Bone & Joint Surgery - British Volume 80:201-207.	Case series n=43 Follow-up=2 years	An intralaminar approach using an operating microscope can provide adequate access to a lateral protrusion. It has the advantage of allowing the treatment of posterolateral protrusion or posterior annular bulge and of spinal stenosis at the same level	Larger case series already included in Table 2.
Ruetten S, Komp M, Merk H et al. (2007) Use of newly developed instruments and endoscopes: full-endoscopic resection of lumbar disc herniations via the interlaminar and lateral transforaminal approach. Journal of	Case series (prospective) n=234 Full-endoscopic lateral transforaminal (n=153) and interlaminar (n=111) resection of herniated lumbar discs (with	Postoperatively 84% of the patients no longer had leg pain, and 12% had only occasional pain. The results of decompression were equivalent to those of conventional procedures. The incidence of traumatization was reduced. Epidural scarring was minimized. The recurrence rate was 6.0%. No serious surgical complications were observed.	Results not differentiated between endoscopic transformainal and interlaminar approaches.

Neurosurgery Spine 6:521-530.	new instruments) Follow up: 2 years	Resection of the herniated disc was technically possible in all cases in which the new instruments were used.	
Passacantilli E, Lenzi J, Caporlingua F et al. (2015) Endoscopic interlaminar approach for intracanal L5-S1 disc herniation: Classification of disc prolapse in relation to learning curve and surgical outcome. Asian J Endosc Surg. DOI:10.1111/ases.12214	Case series n=100 patients Follow-up=2 years	The full endoscopic interlaminar approach is a safe procedure for the removal of intracanal L5-S1 disc herniations. The late follow-up confirms the stability of the results. We suggest treating type A prolapse at the beginning of the learning curve and type B herniations after sufficient experience in the use of the burrs has been achieved.	Larger studies or studies with longer follow-up already included.
Soliman H M (2013) Irrigation endoscopic discectomy: a novel percutaneous approach for lumbar disc prolapse. Eur Spine J. 22:1037–1044 DOI 10.1007/s00586-013-2701-0	Case series n=43 patients Follow-up=24 months	Preliminary clinical experience with irrigation endoscopic discectomy shows it to be as effective as microsurgical discectomy, and in comparison to other percutaneous procedures addressing non-contained herniations, a reduction in the cost, technical difficulty and surgical invasiveness has been demonstrated.	Larger studies or studies with longer follow-up already included.

Wang B, Lu G, Patel AA et al. (2011) An evaluation of the learning curve for a complex surgical technique: the full endoscopic interlaminar approach for lumbar disc herniations. Spine Journal: Official Journal of the North American Spine Society 11:122-130.	Case series n=50 Follow-up=15 months	Misplacement of working portal during the exposure of the ligament flavum and difficulty in indentifying anatomy are potential causes for conversion to open in the initial adoption of FE technique. However, uncommon conditions such as variation of the nerve root origin can also result in conversion to open in experienced hands. Endoscopic experience, proper patient selection and specific radiographic examination are needed to obtain optimal outcomes using a full endoscopic technique for microdiscectomies.	Larger case series with longer follow-up already included in Table 2.
Wang B, Lu G, Liu W et al. (2012) Full-endoscopic interlaminar approach for the surgical treatment of lumbar disc herniation: the causes and prophylaxis of conversion to open. Archives of Orthopaedic & Trauma Surgery 132:1531-1538.	Case series n=30 Follow-up=max 2 years	Excellent clinical and minimally invasive outcomes can be obtained in the surgical treatment of lumbar disc herniation via the interlaminar approach assisted by FE technique.	Larger case series with longer follow-up already included in Table 2.
Wang X, Zeng J, Nie H et al. (2014) Percutaneous endoscopic interlaminar discectomy for pediatric lumbar disc herniation. Childs Nervous System 30:897-902.	Case series n=29 Follow-up=20 months	No severe complications. VAS score for leg and back pain decreased at 1 day postoperatively and kept decreasing until 3 months postoperatively, when it became stable at a low level. ODI kept improving until 6 months postoperatively when it reached a stable low level. Of the patients, 91% reported no longer having leg pain and 9% had occasional leg pain at last follow-up.	Larger case series with longer follow-up already included in Table 2.
Xu H, Liu X, Liu G et al. (2014) Learning curve of full-endoscopic technique through interlaminar approach for L5/S1 disk herniations. Cell Biochemistry & Biophysics 70:1069-1074.	Case series n=36 Follow-up=1-1.5 years	The steep learning curves of perioperative parameters plotted against the number of surgeries conducted suggest that proficiency can be reached reasonably fast	Larger case series with longer follow-up already included in Table 2.

Appendix B: Related NICE guidance for percutaneous interlaminar endoscopic lumbar discectomy for sciatica

Guidance	Recommendations
Interventional procedures	**Percutaneous endoscopic laser lumbar discectomy. NICE interventional procedure guidance 300 (2009).** **(Current guidance)** 1.1 Current evidence on the safety and efficacy of percutaneous endoscopic laser lumbar discectomy is inadequate in quantity and quality. Therefore this procedure should only be used with special arrangements for clinical governance, consent, and audit or research. 1.2 Clinicians wishing to undertake percutaneous endoscopic laser lumbar discectomy should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients and their carers understand the uncertainty about the procedure's safety and efficacy and provide them with clear written information. In addition, the use of NICE's information for patients ('Understanding NICE guidance') is recommended. • Audit and review clinical outcomes of all patients having percutaneous endoscopic laser lumbar discectomy (see section 3.1). 1.3 Surgeons undertaking this procedure should have specific training in the use of lasers and in endoscopy of the spinal canal. 1.4 NICE encourages further research into percutaneous endoscopic laser lumbar discectomy and may review the procedure on publication of further evidence. Research studies should provide long-term outcome data. **Percutaneous intradiscal electrothermal therapy for low back pain. NICE Interventional Procedure Guidance 319 (2009)** **(Current guidance)** 1.1 Current evidence on the safety and efficacy of percutaneous intradiscal electrothermal therapy for low back pain is inconsistent. Therefore this procedure should only be

	used with special arrangements for clinical governance, consent and audit or research. 1.2 Clinicians wishing to undertake percutaneous intradiscal electrothermal therapy for low back pain should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients and their carers understand the uncertainty about the procedure's safety and efficacy and provide them with clear written information. In addition, the use of NICE's information for patients ('Understanding NICE guidance') is recommended. • Audit and review clinical outcomes of all patients having percutaneous intradiscal electrothermal therapy for low back pain (see section 3.1). 1.3 NICE encourages further research into percutaneous intradiscal electrothermal therapy for low back pain. Research should describe patient selection, use validated measures of long-term pain relief and quality of life, address the role of the procedure in avoiding major surgery, and measure long-term safety outcomes. **Percutaneous intradiscal radiofrequency thermocoagulation for lower back pain. NICE Interventional Procedure Guidance 83 (2004).** **(Current guidance)** 1.1 Current evidence on the safety and efficacy of percutaneous intradiscal radiofrequency thermocoagulation for lower back pain does not appear adequate to support the use of this procedure without special arrangements for consent and for audit or research. 1.2 Clinicians wishing to undertake percutaneous intradiscal radiofrequency thermocoagulation for lower back pain should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's efficacy and provide them with clear written information. Use of the Institute's information for the public is recommended. • Audit and review clinical outcomes of all patients having percutaneous intradiscal radiofrequency thermocoagulation for lower back pain.

	1.3 Further research will be useful in reducing the current uncertainty and clinicians are encouraged to collect longer-term follow-up data. The Institute may review the procedure upon publication of further evidence. **Percutaneous disc decompression using coblation for low back pain NICE Interventional Procedure Guidance 173 (2006).** **(Current guidance)** 1.1 Current evidence suggests that there are no major safety concerns associated with the use of percutaneous disc decompression using coblation for lower back pain. There is some evidence of short-term efficacy; however, this is not sufficient to support the use of this procedure without special arrangements for consent and for audit or research. 1.2 Clinicians wishing to undertake percutaneous disc decompression using coblation for lower back pain should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's efficacy and provide them with clear written information. Use of the Institute's information for the public is recommended. • Audit and review clinical outcomes of all patients having percutaneous disc decompression using coblation for lower back pain. 1.3 Further research will be useful in reducing the current uncertainty and clinicians are encouraged to collect longer-term follow-up data. The Institute may review the procedure upon publication of further evidence. **Automated percutaneous mechanical lumbar discectomy. NICE interventional procedure guidance 141 (2005)** 1.1 Current evidence suggests that there are no major safety concerns associated with automated percutaneous mechanical lumbar discectomy. There is limited evidence of efficacy based on uncontrolled case series of heterogeneous groups of patients, but evidence from small randomised controlled trials shows conflicting results. In view of the uncertainties about the efficacy of the procedure, it should not be used without special arrangements for consent and for audit or research. 1.2 Clinicians wishing to undertake automated percutaneous

	mechanical lumbar discectomy should take the following actions. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's efficacy and provide them with clear written information. In addition, use of the Institute's information for the public is recommended. • Audit and review clinical outcomes of all patients having automated mechanical percutaneous lumbar discectomy. The Institute may review the procedure upon publication of further evidence. **Endoscopic laser foraminoplasty. NICE interventional procedures guidance 31 (2003)** 1.1 Current evidence of the safety and efficacy of endoscopic laser foraminoplasty does not appear adequate to support the use of this procedure without special arrangements for consent and for audit or research. Clinicians wishing to undertake endoscopic laser foraminoplasty should inform the clinical governance leads in their Trusts. They should ensure that patients offered the procedure understand the uncertainty about its safety and efficacy and should provide them with clear written information. Use of the Institute's information for the public is recommended. Clinicians should ensure that appropriate arrangements are in place for audit or research. Further research into safety and efficacy outcomes will be useful in reducing the current uncertainty. NICE is not undertaking further investigation at present. **Percutaneous endoscopic laser thoracic discectomy. NICE interventional procedures guidance 61 (2004)** 1.1 Current evidence on the safety and efficacy of percutaneous endoscopic laser thoracic discectomy does not appear adequate for this procedure to be used without special arrangements for consent and for audit or research. 1.2 Clinicians wishing to undertake percutaneous endoscopic laser thoracic discectomy should take the following action. • Inform the clinical governance leads in their Trusts. • Ensure that patients understand the uncertainty about the procedure's safety and efficacy and provide them with clear written information. Use of the Institute's information

	for the public is recommended. • Audit and review clinical outcomes of all patients having percutaneous endoscopic laser thoracic discectomy. 1.3 Further research will be useful in reducing the current uncertainty and clinicians are encouraged to collect longer-term follow-up data. The Institute may review the procedure upon publication of further evidence. **Prosthetic intervertebral disc replacement in the lumbar spine. NICE interventional procedures guidance 306 (2009)** 1.1 Current evidence on the safety and efficacy of prosthetic intervertebral disc replacement in the lumbar spine is adequate to support the use of this procedure provided that normal arrangements are in place for clinical governance, consent and audit. 1.2 A multidisciplinary team with specialist expertise in the treatment of degenerative spine disease should be involved in patient selection for prosthetic intervertebral disc replacement in the lumbar spine. The procedure should only be carried out in patients for whom conservative treatment options have failed or are contraindicated. 1.3 The current evidence includes studies with a maximum follow-up of 13 years, but the majority of evidence is from studies with shorter durations of follow-up. NICE encourages clinicians to continue to collect and publish data on longer-term outcomes, which should include information about patient selection and the need for further surgery. **Percutaneous intradiscal laser ablation in the lumbar spine. NICE interventional procedure guidance 357 (2010)** 1.1 Current evidence on the safety and efficacy of percutaneous intradiscal laser ablation in the lumbar spine is adequate to support the use of this procedure provided that normal arrangements are in place for clinical governance, consent and audit. 1.2 Patients selected for the procedure should be limited to those with severe pain refractory to conservative treatment, in whom imaging studies show bulging of an intact disc, and who do not have neurological deficit requiring surgical decompression.

	Insertion of an annular disc implant lumbar discectomy. NICE interventional procedure guidance 506 (2014) 1.1 Current evidence on the safety and efficacy of insertion of an annular disc implant at lumbar discectomy is limited in quantity and quality. Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research. 1.2 Clinicians wishing to undertake insertion of an annular disc implant at lumbar discectomy should take the following actions: • Inform the clinical governance leads in their NHS trusts. • Ensure that patients and their carers understand the uncertainty about the procedure's safety and efficacy and provide them with clear written information. In addition, the use of NICE's information for the public is recommended. 1.3 NICE encourages further research on insertion of an annular disc implant at lumbar discectomy, particularly comparative trials. All studies should report details of patient selection and recurrence rates. 1.4 Clinicians should enter details about all patients undergoing insertion of an annular disc implant at lumbar discectomy onto the British Spine Registry and review clinical outcomes locally.
NICE guidelines	**Low back pain in adults: early management. NICE clinical guideline 88 (2009).** **(Current guidance)** 1.5 Other non-pharmacological therapies **Electrotherapy modalities** 1.5.1 Do not offer laser therapy. 1.5.2 Do not offer interferential therapy. 1.5.3 Do not offer therapeutic ultrasound. **Transcutaneous nerve stimulation** 1.5.4 Do not offer transcutaneous electrical nerve simulation (TENS).

	Lumbar supports 1.5.5 Do not offer lumbar supports. **Traction** 1.5.6 Do not offer traction. 1.6 Invasive procedures 1.6.1 Consider offering a course of acupuncture needling comprising up to a maximum of 10 sessions over a period of up to 12 weeks. 1.6.2 Do not offer injections of therapeutic substances into the back for non-specific low back pain. **1.9 Referral for surgery** 1.9.1 Consider referral for an opinion on spinal fusion for people who: • have completed an optimal package of care, including a combined physical and psychological treatment programme (see section 1.7) and • still have severe non-specific low back pain for which they would consider surgery. 1.9.2 Offer anyone with psychological distress appropriate treatment for this before referral for an opinion on spinal fusion. 1.9.3 Refer the patient to a specialist spinal surgical service if spinal fusion is being considered. Give due consideration to the possible risks for that patient. 1.9.4 Do not refer people for any of the following procedures: • intradiscal electrothermal therapy (IDET) • percutaneous intradiscal radiofrequency thermocoagulation (PIRFT) • radiofrequency facet joint denervation.

Appendix C: Literature search for percutaneous interlaminar endoscopic lumbar discectomy for sciatica

Databases	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	05/01/2016	Issue 1 of 12, January 2016
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	05/01/2016	Issue 12 of 12, December 2015
HTA database (Cochrane Library)	05/01/2016	Issue 4 of 4, October 2015
MEDLINE (Ovid)	05/01/2016	1946 to November Week 3 2015
MEDLINE In-Process (Ovid)	05/01/2016	December 31, 2015
EMBASE (Ovid)	05/01/2016	1974 to 2015 Week 52
PubMed	05/01/2016	n/a
JournalTOCS	05/01/2016	n/a

Trial sources searched on 17 July 2014

- Clinicaltrials.gov
- ISRCTN
- WHO International Clinical Trials Registry

Websites searched on 17 July 2014

- National Institute for Health and Care Excellence (NICE)
- NHS England
- Food and Drug Administration (FDA) - MAUDE database
- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP – S)
- Australia and New Zealand Horizon Scanning Network (ANZHSN)
- EuroScan
- General internet search

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1 (Endoscop$ adj4 (disk* or disc$)).tw.

2 (Scop$ adj4 (disk* or disc$)).tw.

3 (Percutan$ adj4 (disk* or disc$)).tw.

4 (microdiskectom* or microdiscectom* or diskectom* or discectom*).tw.

5 Diskectomy, Percutaneous/

6	Diskectomy/
7	or/1-6
8	((foramin* or lumbar or spin*) adj4 stenosis*).tw.
9	foraminotomy/
10	Low Back Pain/
11	(low* adj4 back pain*).tw.
12	(low* adj4 back ache*).tw.
13	(low* adj4 backache*).tw.
14	LBP.tw.
15	lumbago*.tw.
16	Sciatica/
17	sciatic*.tw.
18	(chronic* adj4 back pain*).tw.
19	Intervertebral Disc Displacement/
20	Intervertebral Disc Degeneration/
21	(Intervertebr* adj4 (Disk* or disc*) adj4 (Displace* or degenerat*)).tw.
22	((slip* or extrude* or hernia* or prolaps* or an?ulus) adj4 (disc* or disk*)).tw.
23	((discogenic* or diskogenic*) adj4 pain*).tw.
24	(radicular adj4 pain*).tw.
25	Radiculopathy/
26	(lumbar adj4 radiculopath*).tw.
27	or/8-26
28	interlaminar*.tw.
29	SpineTIP*.tw.
30	PEID*.tw.
31	PIED*.tw.
32	IL-PELD.tw.
33	or/28-32

34	7 and 27 and 33
35	animals/ not humans/
36	34 not 35