NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of percutaneous endoscopic laser cervical discectomy

Symptomatic cervical disc herniation occurs when one or more of the spinal discs in the neck bursts and pushes against the spinal cord or nerve roots that run through the backbone. It can cause pain in the neck or back, or pain, weakness and numbness in the arms.

The aim of a percutaneous endoscopic laser cervical discectomy is to remove the part of the disc that is pushing against the spinal cord or nerve root. A small cut is made in the skin and special equipment including a laser is used to heat and destroy some of the disc and remove the part that is sticking out. Surgery is guided by the use of a small flexible camera also inserted though a small cut.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this 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 overview was prepared in November 2008.

Procedure name

- Percutaneous endoscopic laser cervical discectomy

Specialty societies

- British Orthopaedic Association
- Society of British Neurological Surgeons
- British Cervical Spine Society

Description

Indications and current treatment

Symptomatic cervical disc herniation occurs when a portion of the intervertebral disc protrudes into the spinal canal and impinges on a nerve root or the spinal cord. Symptoms include neck, shoulder and back pain, radicular arm pain, weakness and numbness. Many mild episodes settle spontaneously but, in severe cases, serious neurological sequelae may occur. Treatment options include surgical decompression by discectomy with or without graft or disc replacement.

Conservative treatments include the use of analgesics, non-steroidal anti-inflammatory medicines, and physical therapy. Epidural injections of corticosteroid can also be used. Surgery to remove disc material is considered if there is nerve compression or persistent symptoms that are unresponsive to conservative treatment.

The choice of operative technique or approach may be guided by several factors, including the location and size of the disc involved, the degree of calcification and spinal cord deformation, and presenting signs and symptoms.

What the procedure involves

The procedure is carried out with the patient under general anaesthesia, and with endoscopic guidance. It involves removing all or part of the disc using curettes, microforceps and a discotome inserted via a cannula through a small (1–2 cm) retractor port.

A laser is used to ablate the disc material and then shrink and contract the disc further (laser thermodiskoplasty). Any debris is removed with the discotome, and the probe and cannula are removed.

List of studies included in the overview

This overview is based on 152 patients from two case series [1, 2].

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.

Efficacy

A case series of 111 patients treated by percutaneous endoscopic laser cervical discectomy reported that 47% (52/111) of patients were classified as having an ‘excellent’ outcome, 33% (37/111) had a ‘good’ outcome, 8% (9/111) ‘fair’, and 12% (13/111) ‘poor’ [1]. The study used the MacNab criteria, which rates the results of operative interventions using a four-point scale:

- Excellent: no pain or restriction of activity

- Good: occasional back or leg pain of sufficient severity to interfere with the patients' ability to do normal work or capacity to enjoy themselves in leisure hours.
- Fair: improved functional capacity, but handicapped by intermittent pain of sufficient severity to curtail or modify work or leisure activities.
- Poor: no improvement or insufficient improvement to enable increase in activities, further operative intervention required.

This scale was designed for use with patients who have back or leg pain.

Multivariate analysis showed that the presence of radiating arm pain at baseline (odds ratio 2.77, p = 0.043) and lateral disc herniation (odds ratio 2.41, p = 0.029) were independent predictors for an excellent outcome.

Safety

A case series of 111 patients treated by percutaneous endoscopic laser cervical discectomy reported that 3% (3/111) of patients needed additional surgery. They were treated with conventional anterior open discectomy and fusion because of incomplete decompression and symptom aggravation. There were no incidences of infection, haematoma or hoarseness [1].

A case series of 41 patients treated by cervical endoscopic discectomy with a holmium laser reported that vessel compromise because of guide wire positioning occurred in 5% (2/41) of patients. One jugular vein and one carotid artery. Discitis developed in 2% (1/41) of patients, which led to disc space collapse and was treated by vertebral bone fusion[2].

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to percutaneous endoscopic laser cervical discectomy. Searches were conducted of the following databases, covering the period from their commencement to 24th September 2008: 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).

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 herniated or prolapsed cervical discs.
Intervention/test	Percutaneous endoscopic laser cervical 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.

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

- Prosthetic intervertebral disc replacement in the cervical spine. NICE interventional procedures guidance 143 (2005). Available from www.nice.org.uk/IPG143

Table 2 Summary of key efficacy and safety findings on percutaneous endoscopic laser cervical discectomy

Abbreviations used: CT, Computed Tomography; MRI, Magnetic Resonance Imaging;			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Ahn Y (2004)[1] **Case series** Korea Study period: Jan 1998 to Dec 2000 **n = 111** Study population: soft cervical disc herniation. Age: 47 years (mean). Sex: 56% males. Herniation: central 45%, posteriolater 32%, foraminal 23%. Single level surgery 80%, two level surgery 20%. Inclusion criteria: Diagnosis confirmed by magnetic resonance imaging or computerised tomography scan, neck pain or radicular symptoms, refractive to 6 weeks of conservative therapy. Technique: Local anaesthetic. Patient placed in supine position. 3 mm incision, working cannula introduced. Manual discectomy performed under fluoroscopic guidance, then endoscopic laser discectomy to ablate and shrink the herniated disc. Laser set at 0.5–0.8 J/pulse at 10 Hz. Discharge within 24 hours unless complication. **Follow-up: 49 months** Conflict of interest: None.	**Functional mobility** Patients were classified using the MacNab criteria. 47% (52/111) had an 'excellent' outcome, 33% (37/111) had a 'good' outcome, 8% (9/111) 'fair', and 12% (13/111) 'poor'. Patients with radiating arm pain as the chief complaint were more likely to have an excellent outcome ($p = 0.02$). Other factors such as sex, age, duration of symptoms, and presence of motor and/or sensory deficit were not associated with outcome. Patients with a lateral disc herniation (foraminal or posteriolateral) were more likely than those with a central herniation to have an excellent outcome ($p < 0.02$). However, other factors such as hernia size, degree of degeneration, cervical spine curvature, or single or two-level treatment were not associated with outcome. Multivariate analysis showed that the presence of radiating arm pain at baseline (odds ratio 2.77, $p = 0.043$) and lateral disc herniation (odds ratio 2.41, $p = 0.029$) were independent predictors for an excellent outcome.	**Complications** 3% (3/111) of patients needed additional surgery. They were treated with conventional anterior open discectomy and fusion because of incomplete decompression and symptom aggravation. There were no incidences of infection, haematoma or hoarseness.	Consecutive patient cohort Efficacy outcomes were evaluated using the MacNab criteria. This rates the results of operative interventions using a four-point scale. Excellent: No pain or restriction of activity. Good: Occasional back or leg pain of sufficient severity to interfere with the patients' ability to do normal work or capacity to enjoy themselves in leisure hours. Fair: Improved functional capacity, but handicapped by intermittent pain of sufficient severity to curtail or modify work or leisure activities. Poor: No improvement or insufficient improvement to enable increase in activities; further operative intervention required. NB: This scale was designed for back/leg pain and not back/arm pain. Patients with compensation or litigation problems were excluded from this series.

Abbreviations used: CT, Computed Tomography; MRI, Magnetic Resonance Imaging;			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Haufe S M (2004) [2] **Case series** Study period: not reported **n = 41** Study population: not reported. Inclusion criteria: not reported. Technique: Anaesthetic type not reported. 5 mm sheath system inserted over a guide wire at a 30° angel to the spine. Special cutting devices were used to cut the disc and bone to help remove loose disc fragments. Laser and fibreoptic scope used to smooth the surface of the inner disc and eliminate residual loose pieces. **Follow-up: not reported** Conflict of interest: not reported.	Efficacy outcomes were not reported on.	**Complications** Vessel compromise due to guide wire positioning occurred in 5% (2/41) of patients. 1 jugular vein and 1 carotid artery. Discitis developed in 2% (1/41) of patients. This led to disc space collapse and was treated by vertebral bone fusion. There was no incidence of spinal cord injury, phrenic or vagal nerve injury. Surgery was cancelled in one patient due to haematoma formation. Hoarseness that probably resulted from laryngeal nerve injury occurred in 2% (1/41) of patients. This resolved within 3 months. Clicking in the neck occurred in 5% (2/41) of patients.	Patient accrual method not reported. Patients questioned at regular intervals to see if any neural problems after surgery. Patient clinical and demographic characteristics not reported. Inclusion criteria not described.

Validity and generalisability of the studies

- The one study included used an intervention that involved both manual and laser discectomy.
- Most of the patients were treated at one cervical level and some at two levels.
- Few objective outcome measures are described.

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 does not represent the view of the society.

Mr P Sell (British Association of Spinal Surgeons), Mr N Todd (British Orthopedic Association).

- One Specialist Adviser considered this procedure to be a minor variation on an existing technique, while the other classified it as a novel procedure of uncertain safety and efficacy.
- One Specialist Adviser stated that there had been cases of heat damage to the cauda equina when laser was used for lumbar discectomy with concomitant foraminoplasty.
- No published or known anecdotal adverse events were reported, but theoretical adverse events may include failure to achieve decompression, disorientation of the surgeon, excessive heating leading to nerve or vessel damage, and quadriplegia.
- The comparator procedure is open microscopic decompression procedures and the key efficacy outcomes would be the same for both. Minimal scarring is expected.
- The procedure protocol is not yet well established in terms of laser type, wavelength used, energy delivered, and time used.
- Clinicians undertaking this procedure should have cadaveric training and work with an experienced clinician.

- It is not possible to predict the potential impact of the procedure at present. It is unlikely to be viewed by the majority of surgeons as advantageous over standard procedures.

Issues for consideration by IPAC

- Guidance on percutaneous endoscopic laser thoracic discectomy (IPG 61) was published in June 2004. An updated literature search showed that there are no new data on this level of the spine. However, the Committee is now going to consider this procedure and also endoscopic laser lumbar discectomy.

References

1 Ahn Y, Lee SH, Lee SC et al. (2004) Factors predicting excellent outcome of percutaneous cervical discectomy: analysis of 111 consecutive cases. Neuroradiology 46: 378–84.

2 Hauffe SMW, Mork AR (2004) Complications Associated with Cervical Endoscopic Discectomy with the Holmium Laser. Journal of Clniical Laser Medicine & Surgery 22: 57-58.

Appendix A: Additional papers on percutaneous endoscopic laser cervical discectomy

No additional papers were identified.

Appendix B: Related NICE guidance for percutaneous endoscopic laser cervical discectomy

Guidance	Recommendations
Interventional procedures	**Prosthetic intervertebral disc replacement in the cervical spine. NICE interventional procedures guidance 143 (2005)** 1.1 Current evidence suggests that there are no major safety concerns about the use of prosthetic intervertebral disc replacement in the cervical spine, and there is evidence of short-term efficacy. Clinicians wishing to undertake this procedure should take the following actions. • Ensure that patients understand the long-term uncertainties about the procedure and the alternative treatment options. In addition, use of the Institute's *Information for the public* is recommended. • Audit and review clinical outcomes of all patients having prosthetic intervertebral disc replacement in the cervical spine. 1.2 This procedure should only be performed in specialist units where surgery of the cervical spine is regularly undertaken.
Technology appraisals	There is currently no NICE guidance related to this procedure.
Clinical guidelines	There is currently no NICE guidance related to this procedure.
Public health guidance	There is currently no NICE guidance related to this procedure.

Appendix C: Literature search for percutaneous endoscopic laser cervical discectomy

Database	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	10/06/08	Issue 2, 2008
Database of Abstracts of Reviews of Effects – DARE (CRD website)	10/06/08	N/A
HTA database (CRD website)	10/06/08	N/A
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	10/06/08	Issue 2, 2008
MEDLINE (Ovid)	10/06/08	1950 to May Week 4 2008
MEDLINE In-Process (Ovid)	10/06/08	June 09, 2008
EMBASE (Ovid)	10/06/08	1980 to 2008 Week 23
CINAHL (Search 2.0, NLH)	10/06/08	1982 to date (via Dialog)
BLIC (Dialog DataStar)	10/06/08	1993 to date
National Research Register (NRR) Archive	05/06/08	N/A
UK Clinical Research Network (UKCRN) Portfolio Database	05/06/08	N/A
Current Controlled Trials *meta*Register of Controlled Trials - *m*RCT	05/0608	N/A
Clinicaltrials.gov	05/06/08	N/A

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

1	Diskectomy/
2	Endoscopy/
3	1 and 2
4	Diskectomy/
5	Diskectomy, Percutaneous/
6	Decompression, Surgical/
7	(Percutan$ adj5 discectom$).tw.
8	(Percutan$ adj5 diskectom$).tw.
9	(Endoscopic$ adj5 discectom$).tw.
10	(Endoscopic$ adj5 diskectom$).tw.
11	(Posterolateral$ adj5 discectom$).tw.
12	(Posterolateral$ adj5 diskectom$).tw.
13	(Decompress$ adj3 surg$).tw.
14	Microdecompress$.tw.

15	or/3-14
16	Lasers/
17	Laser Therapy/
18	Laser$.tw.
19	Thermodiskoplast$.tw.
20	Thermodiscoplast$.tw.
21	or/16-20
22	15 and 21
23	Animals/
24	Humans/
25	23 not (23 and 24)
26	22 not 25
27	200210$.ed.
28	200211$.ed.
29	200212$.ed.
30	2003$.ed.
31	2004$.ed.
32	2005$.ed.
33	2006$.ed.
34	2007$.ed.
35	2008$.ed.
36	or/27-35
37	26 and 36