

NATIONAL INSTITUTE FOR CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedures overview of percutaneous endoscopic laser thoracic discectomy

Introduction

This overview has been prepared to assist members of the Interventional Procedures Advisory Committee advise on the safety and efficacy of an interventional procedure previously reviewed by SERNIP. It is based on a rapid survey of published literature, review of the procedure by specialist advisors and review of the content of the SERNIP file. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared by ASERNIP-S in October 2002

Procedure name

Posterolateral thoracic discectomy, more usually referred to as:

- endoscopic laser thoracic discectomy
- percutaneous endoscopic thoracic discectomy (with laser)
- endoscopic microdecompressive thoracic discectomy with
- laser thermodiskoplasty

Specialty societies

British Orthopaedic Association.

Description

Executive Summary

There is very little literature pertaining to percutaneous endoscopic thoracic discectomy with laser (posterolateral thoracic discectomy). Only three case series were identified from searches of grey literature and bibliographies, and the quality of reporting in these studies is poor, with subject numbers, lengths of follow up and losses to follow up not stated in every case. No operative or other complications were reported in the identified studies, and virtually all patients were reported to have experienced symptomatic relief. However, the group of patients for whom this procedure is indicated is very small and the procedure does not appear to be used routinely, other than by the two authors included in this review.

Indications

Symptomatic thoracic disc herniation occurs when a portion of the intervertebral disc protrudes into the spinal canal and impinges on a nerve root. In comparison with asymptomatic thoracic disc herniation, which has a prevalence of approximately 7–15%,¹ symptomatic thoracic disc herniation is rare, accounting for between 0.25 and 0.57% of all disc herniations reported in the literature.¹⁻³ Typically, symptoms appear up to 2 years before the patient presents for treatment.³ Symptoms include back pain, radicular pain, nondermatomal leg pain, bladder dysfunction, and lower extremity weakness. If left untreated serious neurological sequelae may occur.³ The choice of operative approach may be guided by a number of factors, including the location and size of the disc involved, degree of calcification and spinal cord deformation, patient medical condition and presenting signs and symptoms, presence of dura surrounding the posterolateral margins of the disc, and surgeon's experience with varying techniques.⁴ As Stillerman and coworkers.⁴ note, "No universally accepted selection criteria exist to help the surgeon choose the best operation for disc removal. Moreover, no single surgical approach is best suited for all situations." (p.627).

A number of endoscopic techniques have been described.⁵⁻⁹ However, these techniques all use multiple portal incisions and are performed under general anaesthetic. By contrast, endoscopic laser thoracic discectomy aims to decompress the disc using a percutaneous needle and laser ablation. As a consequence it is only indicated where the disc herniation is contained inside the nucleus pulposus and is contraindicated where free disc fragmentation is evident.^{10,11} Unlike open procedures, which are indicated for persistent severe myelopathy,⁴ endoscopic laser thoracic discectomy is contraindicated in patients with myelopathy, or other vascular pathologies, as well as in patients with cancer, degenerative or congenital bony defects of the spine and severe spinal cord compression.^{10,11}

What the procedure involves

The procedure as described by Chiu¹² was developed from the similar application of percutaneous laser discectomy for the lumbar and cervical spine (for example Choy,¹¹ and Chui *et al.*¹³). After intraoperative pain provocation test (with fluoroscopic dye and spinal needle) confirms the patient's eligibility for surgery, the disc is decompressed under endoscopic magnification using curettes, microforceps and discectome inserted through a small cannula. Small osteophytes are removed using microcurettes and rasps, and then a Holmium:YAG laser (500 J, 8.5 W, 10 Hz, 5 seconds on/5 seconds off) is used to ablate disc material and then at a lower power setting (300 J, 5 W) to shrink and contract the disc further (laser thermodiskoplasty). Any charred debris is removed via the discectome and the probe and cannula are removed after inspection shows that the site is clear. Neurological status is monitored intraoperatively, and a postoperative chest X-ray is used to rule out pneumothorax.

Standard discectomy for TDH may be either by open postero-lateral or anterior approaches. Percutaneous endoscopic approaches lessen the morbidity of the procedure by allowing access and visualisation of the anterior and lateral aspects of the disc. The choice of approach will depend upon the characteristics of the disc herniation and the surgeon's experience with the above techniques. Percutaneous endoscopic laser thoracic discectomy is purported to reduce morbidity and promote earlier return to work. The advantages of the technique are that it does not interfere with the bones or joints of the spine, or require manipulation of nerves or the spinal cord. Postoperative scarring is said to be lower due the use of micro-instruments inserted through the small cannula.

Literature reviews

A systematic search of MEDLINE, PREMEDLINE, EMBASE, Current Contents, PubMed, Cochrane Library and Science Citation Index using Boolean search terms was conducted, covering the period from the inception of the databases until October 2002. The York Centre for Reviews and Dissemination, Clinicaltrials.gov, National Research Register, SIGLE, Grey Literature Report (2002), relevant online journals and the Internet were also searched in October 2002. Searches were conducted without language restriction.

The searches of online databases retrieved no studies that contained safety and efficacy data on percutaneous endoscopic thoracic discectomy **with laser**. References were obtained from grey literature searches of the Internet, hand-searching of bibliographies, and one book chapter provided by NICE. Included studies are highlighted in bold in the reference list.

List of studies found

Total number of studies: 3

- Case series 3
(in one¹⁴, the patients are likely a subset of the 100 patients reported in another by the same author¹⁰)

Summary of key efficacy and safety findings

See following tables.

Abbreviations

CT	computed tomography.
MRI	magnetic resonance imaging.
Ho:YAG	holmium:yttrium-aluminium-garnet.
Nd:YAG	neodymium:yttrium-aluminium-garnet.

Table 2 Summary of key efficacy and safety findings

Study details	Key efficacy findings	Key safety findings	Appraisal/Comments
Case series			
Chiu & Clifford 2000, Chiu 2002^{10,12,15}, USA 100 patients (152 discs) Follow-up, mean (months): 24 (range 4– 47) Selection criteria: Consecutive patients with pain in thoracic spine, MRI or CT confirmed fully contained thoracic disc herniation, no relief from ≥ 12 wks conservative therapy and positive intraoperative discogram and pain provocation disc injection test	96% reported good to excellent results/ symptomatic relief 4 patients persistent thoracic discomfort and paresthesia (pain improved 80% overall) Average time to return to work 10 days (for non-Worker's Compensation cases)	No operative complications.	Potential for bias: Although reported outcomes are the same, mean length of follow up is longer in 2002 presentation than in 2000 paper. Outcome measures and their validity: Outcome measures used were not stated, and meaning of "good to excellent" results is not defined. Other comments: Book chapter is published by newly formed American Academy of Minimally Invasive Spinal Medicine and Surgery in book co-edited by Chiu. Other versions of data published on Chiu's website
Chiu 2002¹⁴, USA Number of patients not stated Follow-up: not stated Selection criteria: patients with high (T1–4) thoracic disc herniation without myelopathy with 12 weeks failed conservation therapy	All patients had symptomatic relief 1 patient had persistent thoracic pain and paresthesia Average time to work 10 days for non-worker's compensation patients	No postoperative complications	Potential for bias: Could not be determined due to lack of detailed information. Outcome measures and their validity: Outcome measures not stated. Other comments: Likely these are subset of 100 patients reported in Chiu & Clifford (2000). Abstract from Chiu's website.
Choy 1998¹¹, USA 6 patients (subset of 512 patients undergoing	All patients free of symptoms, 3 immediately, 1 at 2 weeks, 2 at 4 weeks post-operatively.	No complications	Potential for bias: Could not be determined due to lack of detailed information.

Study details	Key efficacy findings	Key safety findings	Appraisal/Comments
laser discectomy for lumbar, cervical and thoracic herniated disc) Follow up: up to 12 years Selection criteria: Patients with MRI documented disc herniations and pain syndrome, with 3 months failed conservative therapy, with contained disc herniation.			Outcome measures and their validity: MacNab criteria (which is validated) Other comments: Note: Choy used Nd:YAG laser rather than Holmium:YAG laser.

Specialist Advisor's opinions

Specialist advice was sought from the *British Orthopaedic Association*.

- the incidence of herniated thoracic discs requiring treatment is very low
- patients may be treated with percutaneous endoscopic thoracic discectomy unnecessarily.

Issues for consideration by IPAC

The use of endoscopic techniques for thoracic discectomy is a relatively new application of minimally invasive surgery for the spine. As Chiu & Clifford¹⁰ note, surgical knowledge of the anatomy around the thoracic spine is essential for successful application of this technique. As they state, "...a probe placed too closely to the midline may cause neurological damage, and too interiorly, injury to the major vessels or the sympathetic chain. A pneumothorax is a possibility if the pleura or lungs are penetrated." (p.216). The steep learning curve for endoscopic techniques, the high cost of specialised instrumentation and the relatively low incidence of suitable surgical candidates are all factors contributing to the very small number of surgeons who appear to be using this technique at present.

References

1. Dinh DH, Tompkins J, Clark SB. Transcostovertebral approach for thoracic disc herniations. *Journal of Neurosurgery* 2001;**94**(1:Suppl):Suppl-44.
2. Curcin A, Lucas P. Spondylolisthesis after posterolateral thoracic discectomy. Case report and literature review. *Spine* 1992;**17**(10):1254–6.
3. Simpson J, Silveri C, Simeone F, Balderston R, An H. Thoracic disc herniation. Re-evaluation of the posterior approach to modified costotransversectomy. *Spine* 1993;**18**(13):1872–7.
4. Stillerman CB, Chen TC, Couldwell WT, Zhang W, Weiss MH. Experience in the surgical management of 82 symptomatic herniated thoracic discs and review of the literature. *Journal of Neurosurgery* 1998;**88**(4):623–33.
5. Oskouian RJ, Jr., Johnson JP, Regan JJ. Thoracoscopic microdiscectomy. *Neurosurgery* 2002;**50**(1):103–9.
6. Perez-Cruet M, Fessler RG, Perin N. Complications of minimally invasive spinal surgery. *Neurosurgery* 2002;**51**(5 (Supplement 2)):S2-26–S2-36.
7. Anand NM, Regan JJM. Video-Assisted Thoracoscopic Surgery for Thoracic Disc Disease: Classification and Outcome Study of 100 Consecutive Cases With a 2-Year Minimum Follow-up Period. [Article]. *Spine* 2002;**27**(8):871–9.
8. Jaikumar SMD, Kim DHM, Kam ACM. History of Minimally Invasive Spine Surgery. [Miscellaneous Article]. *Neurosurgery* 2002;**51**(5):S2.
9. Dickman CAM, Rosenthal DMD, Karahalios DGM, Paramore CGM, Mican CAM, Apostolides PJM, Lorenz RMD, Sonntag VKH. Thoracic Vertebrectomy and

Reconstruction Using a Microsurgical Thoracoscopic Approach. [Article].
Neurosurgery 1996;**38**(2):279–93.

10. Chiu JC, Clifford TJ. Percutaneous endoscopic thoracic discectomy. In: Savitz M, Chiu JC, Yeung T, editors. *The practice of minimally invasive spinal technique*. Richmond (VA): American Academy of Minimally Invasive Spinal Medicine and Surgery Education; 2000.
11. Choy D. Percutaneous laser disc decompression (PLDD): twelve years' experience with 752 procedures in 518 patients. *Journal of Clinical Laser Medicine and Surgery* 1998;**16**(6):325–31.
12. Chiu JC. *Endoscopic microcompressive thoracic discectomy with laser thermodiskoplasty*. Paper presented to the International 20th Jubilee Course for Percutaneous Endoscopic Spinal Surgery and Complimentary Techniques, Zollikerberg/Zurich - Switzerland, Januage 24–25, 2002. 2002.
13. Chiu JC, Clifford TJ, Greenspan M, Richley RC, Lohman G, Sison RB. Percutaneous microdecompressive endoscopic cervical discectomy with laser thermodiskoplasty. *Mount Sinai Journal of Medicine* 2000;**67**(4):278–82.
14. Chiu JC. A new outpatient surgical technique, percutaneous high thoracic (T1-T4) microcompressive endoscopic thoracic discectomy with laser thermodiskoplasty for non-extruded thoracic herniated disc. www.spinecentre.com/abstracts . 2002.
15. Chiu JC. Minimally invasive endoscopic assisted thoracic discectomy for thoracic herniated nuclues pulposus. www.spinecentre.com/abstracts . 2002.