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The Surgeon, Journal of the Royal Colleges of Surgeons of Edinburgh and Ireland
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Review

Transforaminal endoscopic spinal surgery: The future 'gold standard' for discectomy? – A review

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ARTICLE INFO

Article history:
Received 27 October 2011
Received in revised form
5 March 2012
Accepted 9 May 2012
Available online 18 June 2012

Keywords:
Discectomy
Endoscopic
Microdiscectomy
Trans-foraminal
Surgery

ABSTRACT

Background: Lumbar disc prolapse is common and the primary method of care in most centres is still open discectomy facilitated by microscope or loupe magnification and illumination. Hospitalisation may be less than 24 h, but post-operative pain usually requires an overnight stay. This review describes transforaminal endoscopic spinal surgery (TESS) using HD-video technology, that is generally performed as a day case procedure under sedation or light general anaesthesia, and collates the evidence comparing the technique to microdiscectomy.

Methods: The method of TESS is described and an electronic literature search performed to identify papers reporting clinical outcomes. International data were translated where necessary and proceedings' abstracts included. In addition, papers held by the authors and colleagues in personal libraries were carefully cross-referenced to the obtained database.

Results: Analysis of the data supports the use of a transforaminal endoscopic approach to the lumbar intervertebral disc and suggests that outcomes following surgery are at least equivalent to those following microdiscectomy. Significant cost-savings in terms of in-patient stay may be generated. In addition, there is also some evidence supporting endoscopic surgery for relief of foraminal stenosis.

Conclusion: Based on current evidence there are good arguments supporting a more widespread adoption of transforaminal endoscopic surgery for the treatment of lumbar disc prolapse with or without foraminal stenosis.

Introduction

Lumbar disc herniation, with a reported prevalence of 1–3%[1] is the commonest pathological process leading to spinal surgery. However, despite dramatic advancements in minimally invasive surgery in other fields, the treatment of disc prolapse in many centres has made only small advances since the initial description of the pathology in the early 1930s.[2,3] This is a recognition of the fact that laminotomy and discectomy produce good to excellent results in up to 90% of patients, even without use of an operating microscope.[4] However, whether a ten percent failure rate from an

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1479-666X/$ – see front matter
doi:10.1016/j.surge.2012.05.001

invasive procedure, producing significant epidural scarring, is acceptable in the 21st Century is a matter for debate. This is especially the case if newer methods are associated with a shorter hospital stay and lower cost base.

The first attempt to improve matters was in the 1960's, when chymopapain injection was introduced as an alternative to lumbar discectomy. There was evidence of a satisfactory outcome in approximately 75% of treated patients but strong evidence from randomized controlled trials suggested that although more effective than placebo, chemonucleolysis was less effective than discectomy.[5] These facts, combined with concerns regarding an allergic response to chymopapain limited sales from the pharmaceutical companies leading eventually to cessation of compound production.

In the 1970s, similar 75% rates of success were reported following percutaneous dorso-lateral nucleotomy,[6] leading to the availability of a plethora of mechanical devices in the 1980's that would core out the centre of the disc relieving pressure on the exiting root. Outcomes never unfortunately reach those of standard discectomy.[1–9] and even advanced techniques using laser to vaporize the nucleus and lay open the foramen (endoscopic laser foraminoplasty) have not been widely adopted.[10–12] These methods did however lay a base for the current revolution in care that results from access through the safe extraforaminal working zone,[6] improved arthroscopic equipment and high definition video.[13–15]

Surgical approach and technique for transforaminal endoscopic spinal surgery

Operating technique

The operation is possible with the patient lying laterally or prone. Optimal positioning of the patient is essential. The authors prefer the lateral position for the following reasons. Firstly, a pillow under the waist will open up the foramen and allow the dura to fall down to the contra-lateral side avoiding damage on introduction of the cannula. Secondly, the reduced intra-abdominal pressure will decrease bleeding. This is especially important in larger patients. Thirdly, and perhaps of greatest importance, it is easier for the surgeon to maintain verbal contact with the patient (Fig. 1).

We generally advise that the procedure is performed under sedation and local anaesthesia rather than general anaesthesia. The patient is then able to warn the surgeon if instrumentation impinges on a nerve root. It is essential to have orthogonal bi-planar imaging (AP and Lateral) with an image intensifier and confirmation of the position of any annular tear, protrusion and/or sequestrated disc material may be obtained by intra-operative discography.

The position of the iliac crest is marked and a line is drawn along the spinous processes. With X-ray guidance, a line is then drawn on the skin in line with the isthmus of the lamina to the upper backside of the lower vertebral body. Local anaesthesia is administered and an 18 guage needle then introduced between 10 and 15 cm from the midline of the spine, to the disc herniation, passing over the anterior side of the isthmus. One should aim at a position a few millimetres medial of the medial interpedicular line through the caudal part of the foramen (as low through the foramen as possible). The position of the needle is checked in two planes during its introduction with the image intensifier. After the tip of the needle has reached the correct position, a discogram may be performed, if required, to further delineate the pathology and a guide wire introduced (Figs. 2,3).

A small skin incision of 8 mm is then made and the needle removed leaving the guide-wire in situ. A 2 mm conical rod is introduced over the guiding wire, and then sequentially the first, second and third sleeves (guiding tubes) dilating the soft tissues to 6.5 mm. At the levels L4/L5 and L5/S1 the procedure is usually carried out close to the iliac crest. Passing the iliac crest may be painful and it is recommended that extra anaesthetic is placed down to the iliac crest at this stage.

The second and third sleeves are then removed and over the first sleeve, the first of sequentially larger reamers introduced anti clockwise, to avoid damage to the spinal muscles as shown in Fig. 4. The patient is told to alert the surgeon if he or she experiences pain. In the case of L4/5 and L5/S1 herniations this is usually localised under the knee. Occasionally, pain is felt in the trochanteric region during reaming or in the proximal upper lateral leg, although more commonly the patient is comfortable and can talk to a member of the team.

Continuously checking with the image intensifier the lamina may then be reamed (cutting clockwise) and the reamer advanced safely to 1 or 2 mm inside the medial pedicular line. The procedure is repeated with each of the sequentially larger rods, tubes and reamers. The working cannula can be introduced over the third conical rod. Its tip should be located on the herniated disc (Fig. 5).

The endoscope may now be introduced and the hernia removed (Fig. 6). Sometimes a large sequestered disc can be removed immediately, but in most cases the disc fragments have to be taken out with small forceps. The patient should be asked to confirm that no pain is being experienced on leg movements. After removing the hernia the working cannula is also removed and the skin is closed with a subcutaneous suture and a steristrip. Two hours following surgery the patient can mobilise and be discharged home.

Figure 1 – Theatre set-up.