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ORIGINAL STUDY

Posterior endoscopic discectomy for the treatment of lumbar disc herniation

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The procedure of posterior endoscopic discectomy (PED) is an attempt to allow for a standard familiar microsurgical discectomy to be performed using standard microsurgical techniques via a minimally invasive approach. The aim of this study was to evaluate our results with PED for lumbar disc herniation and to assess the advantages, disadvantages and clinical outcomes of the technique. Between February 2002 and August 2004, 71 patients with a mean age of 44 years (range : 24 to 73) underwent PED. The operated disc levels were L5-S1 in 37 patients, L4-L5 in 26 patients and L3-L4 in 8 patients. Mean operative time was 84 min. (41-135 min.). All patients experienced substantial relief of their leg pain immediately after the operation, mobilised very early after recovery from the anaesthesia and were discharged home within 24 hours of surgery with only oral NSAID +/- myorelaxants. PED has advantages like better illumination, better magnification, and better visualisation through the rotation of the 25° lens, minimal bone resection and minimal epidural fibrosis, less postoperative pain, better cosmesis, shorter hospitalisation, early mobilisation and shorter recovery. On the other hand, PED has a longer learning curve than open discectomy, the operative time is usually longer than with open procedures and bidimensional vision may cause loss of depth sensation, and it entails a longer anaesthesia time due to the preparation period of the system.

Keywords : microendoscopic discectomy ; lumbar disc herniation ; minimal invasive spine surgery.

INTRODUCTION

In 1934, Mixter and Barr (*12*) first reported the surgical treatment of patients with herniated lumbar discs by laminectomy and discectomy. In 1964, first attempts of percutaneous approaches to the lumbar disc through a posterolateral entry point had started with the use of chymopapain to achieve nucleolysis (*17*). Percutaneous lumbar nucleotomy by the same approach using manual instruments was subsequently introduced in 1975 (*8*). Later on, percutaneous lumbar disc surgery via a posterolateral route developed to include the use of automated disc removal devices (*13*), spinal endoscopy (*16*) and the laser (*4*). Although these techniques are minimally invasive, they have not proven as effective as open lumbar disc surgery, especially in cases

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having bony or ligamentous pathology associated with disc herniation. The indications for these procedures have generally been limited to contained lumbar disc herniations, and free fragment (non-contained) disc pathologies have remained as contraindications for percutaneous lumbar disc surgery.

Caspar (*2*) in 1977 and Williams (*19*) in 1978 reported refinements in approach with the use of a microsurgical technique. Since then, the use of microscope has permitted minimally invasive techniques (*11, 13, 17*), many of which have suffered from the inability to allow direct visualisation of the pathological entity and the neural elements, thereby limiting their application and effectiveness. Over the years, interest in minimal access spinal technologies has increased dramatically. The potential benefits of small incisions, limited tissue disruption, enhanced visualisation and illumination, shorter hospital stays, and faster recovery times have been the incentive to pursue these technologies.

In recent years, some surgeons have tried to combine the less invasive microsurgical technique via the traditional midline posterior approach with modern endoscopic technology. They have developed new systems for endoscopic posterior discectomy, either with a conic "freehand" working channel (the Endospine by Destandeau (*5*) or with a tubular retractor [the MicroEndoscopic Discectomy (MED) System], introduced by Foley and Smith in 1996, with a preliminary series at the end of 1997 (*7*). The latter technique has the same goal as any conventional open or mini-open lumbar discectomy (to decompress the affected nerve root), accomplished by applying standard, time-tested midline posterior surgical techniques, but under endoscopic visualisation and through a small tubular retractor. It appears to be very versatile and complete, with a high success rate, and it is still in constant evolution and improvement (METR'x system). With this true endoscopic "thru-a-tube" surgery, it is possible to perform the successful removal of disc and/or bony pathology that is compressing the nerve root, like in open approaches, but with a small skin incision and less disruption of the fascia and paraspinous muscles, which reduces postoperative backache. For these reasons, METR'x greatly reduces the average hospital stay for routine lumbar discectomy, and under some conditions it could be an out-patient procedure.

The purpose of this study was to evaluate our results with the PED (using the METRx system) for lumbar disc herniation and to discuss the advantages, disadvantages and clinical outcomes of this new technique.

MATERIALS AND METHODS

The procedure can be performed under regional or general anaesthesia. We think that general anaesthesia is preferable in the first period of experience, and is still advisable in anxious patients or in difficult cases, when an eventual open conversion may be required. The operating room should be of adequate size to accommodate the fluoroscopy unit, its monitor, and the video equipment for the endoscope. A microscope must be ready as well, in case of open conversion. The C-arm fluoroscope is then positioned to obtain lateral fluoroscopic images of the operative lumbar interspace. A flexible arm assembly is attached to the operating table rail ; this device holds the tubular retractor with the endoscope in a stable position, freeing the surgeon's hands. Once the operative field has been prepped and draped, the lumbar midline is identified and a second line is drawn parallel to it, approximately 1-1.5 cm to the side of the disc herniation.

The level of the herniated disc is precisely localised with the help of a thin K-wire that is inserted through the muscles, directed downward the superior lamina. Three or four progressive cannulated soft tissue dilators are now put over the guide wire and each other (fig 1). The surgeon can confirm proper placement of the dilator by lateral fluoroscopy in the sagittal plane, and by palpating the lamina with the tip of the dilator in the axial plane. In this fashion, just lateral to the base of the spinous process and just above the laminar edge, the correct positioning of the dilator is obtained. The tubular retractor is advanced over the final dilator down to the lamina. Its proper positioning is confirmed fluoroscopically, and it is then connected to the flexible arm assembly to maintain its position and the operative field (fig 2). This tube, which is called the tubular retractor, contains a special video camera with a magnifying lens and a fiberoptic light source that illuminates the tissues and relays the images to a separate video screen.

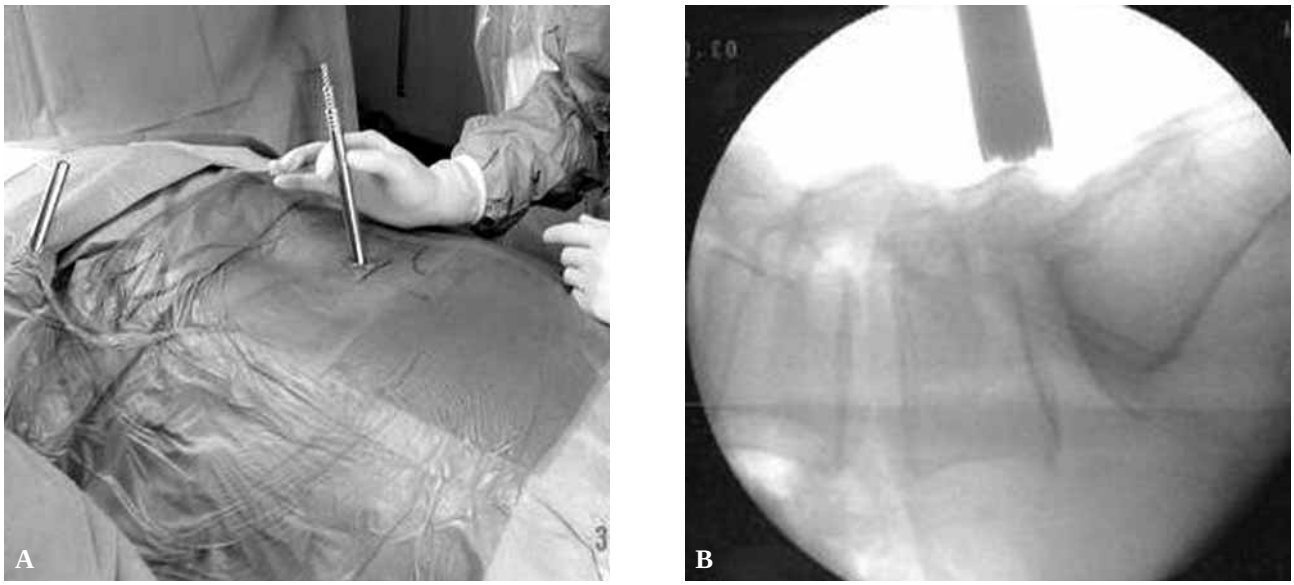

Fig. 1A, B. — Three or four progressive cannulated soft tissue dilators are now put over a guide wire and each other and the position is controlled under fluoroscopy.

After some soft tissue removal with a small rongeur and hemostasis with a modified bipolar forceps, the inferior edge of the superior lamina is identified using a curette. The ligamentum flavum is gently detached from the lamina, and generally a small laminotomy and/or minimal facetectomy is performed. The ligamentum flavum is then opened using small scissors or a special protected knife, and then removed with a Kerrison rongeur. Once identified, the nerve root is exposed with a gentle epidural dissection. In this way, if necessary, the root can be retracted medially or explored in its axilla with a modified retractor or ball-tip probe. Free fragments or contained disc herniations can be identified in this fashion, and removed. The discectomy is then performed with pituitary rongeurs in a standard fashion, as usually done in a standard open microdiscectomy. Afterwards, the root and dural sac are finally explored to check for any residual compression and/or retained disc fragments, controlling epidural bleeding, if significant, with the bipolar forceps.

When the operation is over, Adcon gel is applied to the surgical area to prevent epidural fibrosis. The tubular retractor is removed and the incision, less than 2 cm, is closed in appropriate manner. All patients received prophylactic antibiotics preoperatively. All procedures were performed with patients in the prone position.

Microendoscopic discectomy involving the METRx system was performed in 71 consecutive patients for lumbar disc herniations between February 2002 and August 2004. The mean age was 44 (range ; 24 to 73) years and the male to female ratio was 40/31. The operated disc levels were L5-S1 in 37 patients, L4-L5 in 26 patients and L3-L4 in 8 patients. All surgeries involved only a single level and all disc herniations were intracanalar.

At the last follow-up, pain was assessed by the help of VAS scores and patient satisfaction was evaluated by a scale from 0 to 100 (with 0 being poor to 100 being excellent).

RESULTS

The mean duration of symptoms prior to surgery was 18.4 weeks. Conservative care included pain management, bed rest, physical therapy and epidural steroid therapy. The most common location of the herniation was at the level of the intervertebral disc space ; however, several large cephalad and caudally migrated fragments were removed (fig 3). The mean operative time was 84 minutes (range, 41 to 135), and the mean blood loss was less than 50 ml (28 ml on average). All patients experienced substantial relief of their leg pain immediately after the operation, mobilised very early after the recovery from the anaesthesia and were discharged home

Fig. 2A, B. — The tubular retractor is advanced over the final dilator down to the lamina. Its proper positioning is confirmed fluoroscopically, and it is then connected to the flexible arm assembly to maintain its position and the operative field.

in 24 hours of surgery with only oral NSAID +/- myorelaxants.

Intraoperative complications in the first 10 cases included two dural tears that were primarily repaired. These patients were admitted for 48 hours of bed rest. No delayed cerebrospinal fluid leaks or pseudomeningocoeles developed. We have not seen any superficial or deep infection, nor any systemic complication in any of our cases. One patient required reoperation (open microdiscectomy) for recurrent disc herniations at the same level three weeks after the surgery.

The patients reported pain results according to VAS scale at the latest follow-up (average follow-up of 16 months, range from 6 to 36 months). With regard to low back pain, the mean pain discomfort scores measured on a VAS were respectively 9.2 and 1.3 preoperatively and at the last follow-up visit. With regard to leg pain, the mean VAS pain scores decreased from 8.9 to 1.2 after the operation. Patient satisfaction with physician, hospital, and office services, as scored on a scale from 0 to 100 (with 0 being poor to 100 being excellent) was on average 98.2. At the last follow-up visit, 100% of the patients stated that "…all things considered, they would have the surgery again for the same condition".

DISCUSSION

Minimally invasive techniques in all areas of surgery have gained momentum in recent years. Spinal surgery has been no exception. Unfortunately, minimally invasive techniques have often been equated with minimally effective procedures. The procedure involving METRx instrumentation and technique is an attempt to allow for a standard familiar microsurgical discectomy to be performed using standard microsurgical techniques via a minimally invasive approach (*10*).

It is important that the complication rate associated with the METRx lumbar discectomy is comparable with that in standard microdiscectomy series. In Palmer's series (*14*) there was a 0.8%

Fig. 3. — Preoperative sagittal **(A)** and axial **(B),** postoperative sagittal **(C)** and axial **(D)** MRI images of L4-L5 disc herniation

wound infection rate, a 0.8% discitis rate, and a 2.33% dural tear rate. These rates compared favourably with those reported by Williams (*19*) (0, 0, and 0%, respectively), Ebling *et al* (*6*) (3.3, 0.8, and 3.9%, respectively), Caspar *et al* (*3*) (0.7, 0.7, and 6.7%, respectively), and Pappas *et al* (*15*) (7.2, 0.5, and 1%, respectively). Our reoperation rate was 1.8% (only one patient in a mean follow-up of 4.6 years). This included one early re-herniation at the same level. The aforementioned authors reported reoperation rates of 14, 5.5, 5.7, and 3%, respectively.

The success rates are in general quite high with all surgical procedures for herniated lumbar discs with success rates of 73 to 94 % (*1, 3, 7, 9, 14, 18, 19*). In our series, 100% of patients stated that "all things considered, they would have the surgery again".

PED in which METRx instrumentation is used is a clinically and cost-effective treatment for herniated lumbar discs. Results and complications were comparable with those associated with standard microdiscectomy techniques. It is a good treatment option in selected cases of lumbar disc herniation. It has advantages like better illumination, better magnification, and better visualisation through the rotation of the 25º lens, minimal bone resection and minimal epidural fibrosis, less postoperative pain, better cosmesis, shorter hospitalisation, early mobilisation and shorter recovery. On the other hand, PED has a longer learning curve (longer than open discectomy, 10-20 cases), the operative time is usually longer than the open procedures and bidimensional vision may cause loss of depth sensation, and longer anaesthesia time due to the preparation period of the system.

Our results, as well as those from other authors, are very positive and encouraging, and we believe that in few years the microendoscopic approach will become the new "gold standard" for lumbar disc surgery.

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