

PAIN

Interlaminar approach for epiduroscopy in patients with failed back surgery syndrome

M. Avellanal<sup>1 2 3\*</sup> and G. Diaz-Reganon<sup>1 2 3</sup>

<sup>1</sup>Pain Clinic, Hospital de Madrid, Madrid, Spain. <sup>2</sup>Pain Clinic, Hospital La Moraleja Sanitas, Madrid, Spain. <sup>3</sup>Department of Anesthesiology, Intensive Care and Pain Clinic, Hospital General Universitario Gregorio Marañón, c/ Dr Esquerdo 46, Madrid 28007, Spain

\*Corresponding author. E-mail: mavellanal@telefonica.net

**Background.** Epiduroscopy is a relatively new diagnostic and therapeutic technique used in patients with chronic low back pain with or without radiculopathy. We present our experience with a new interlaminar approach in patients with failed back surgery syndrome (FBSS).

**Methods.** Patients with severe symptoms of FBSS who did not respond to other treatments were included. Lumbar epiduroscopy was performed via interlaminar approach through a 14 G epidural needle under fluoroscopy. A flexible, 0.77 mm, endoscope was introduced through a 4F catheter into the epidural space and advanced in a cephalad direction. Flushes of normal saline through the catheter (via a Y-adapter/haemostasis valve) enabled distension of the space. Adhesions were mechanically mobilized under direct vision. A mixture of triamcinolone 60 mg, hyaluronidase 600 IU, and bupivacaine 0.0625% was instilled.

**Results.** Nineteen patients were included. The mean number of operations at lumbar level was 2.26. Major findings included adhesions, inflammation, stenosis, and nerve root hypotrophy. The visual analogue scale (VAS) score was 7.89 at baseline, 5.95 ( $P<0.001$ ) 3 months later, and 6.05 ( $P<0.001$ ) 6 months later. Six patients (31.6%) did not show any improvement, and six other patients showed a very significant improvement (at least three points reduction in the VAS) 3 months later. We had four cases of dural puncture, but only one patient required hospital admission.

**Conclusions.** We have described a new procedure for epiduroscopy with approximately 50% reduced outer diameter of the catheter, which allows interlaminar approach. Its diagnostic efficacy is clear and there were a significant number of patients who had improved outcome.

*Br J Anaesth* 2008; **101**: 244–9

**Keywords:** epidural; epiduroscopy; pain, chronic; radiculopathy; spinal cord, extradural space

Accepted for publication: May 6, 2008

Epiduroscopy (periduroscopy, epiduraloscopy, extraduroscopy, and spinal endoscopy) is a relatively new minimally invasive technique that offers diagnostic and therapeutic advantages in cases of chronic low back pain and radiculopathy.<sup>1</sup> It is especially interesting in patients with pain after back surgery or failed back surgery syndrome (FBSS), which can be difficult to treat.<sup>2 3</sup> In these cases, epiduroscopy can give us a better understanding of the cause of pain and improve the quality and efficacy of steroid injection or lysis of adhesions when needed.

The conventional approach for lumbar epiduroscopy is via sacral hiatus using a 4 mm (8.5 F) introducer and

inserting through it a flexible fibrescope covered with a video-guided catheter measuring 2.4–2.8 mm in diameter. Saline instillation via one side-channel of the catheter is used for distending the epidural space.<sup>4–6</sup>

Although some authors have used an interlaminar approach for epiduroscopy, it has only been made in investigational studies introducing only the fiberoptic endoscope (0.5–0.9 mm) (outer diameter), without a steering catheter, via a Tuohy needle.<sup>7</sup> These approaches were very limited by the inner diameter of the Tuohy needle, and made it impossible to administer saline for improving vision or any drug for treatment.

We present our experience with a new procedure of lumbar epiduroscopy via interlaminar approach in patients with FBSS. In this new approach, a 14 G epidural needle was used to allow conventional diagnostic and therapeutic interventions.

## Methods

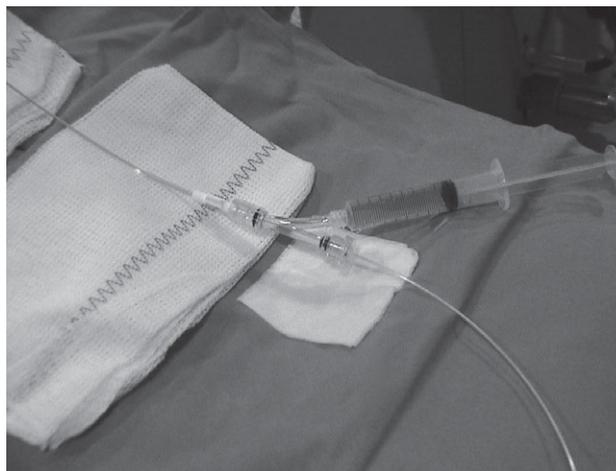
This study was approved by the Hospital Ethical Committee. Epiduroscopy was offered in our pain clinic to 19 patients (aged 18 yr or older) with a history of FBSS with symptoms and signs of severe chronic sciatica (visual analogue scale, VAS  $\geq 7$ ) defined as pain in the distribution of a lumbar nerve root with or without back pain. Duration of pain was at least 1 yr from the last surgery. All patients selected in this study had received conventional treatment including multimodal analgesia [opioids, non-steroidal anti-inflammatory drugs (NSAIDs), and coadjuvants], physical therapy, epidural steroids, and epidural lysis of adhesions with Racz catheter without response. The patients accepted the procedure and written informed consent was obtained from them. VAS score was re-evaluated 3 and 6 months after the procedure.

Electromyography, lumbar magnetic resonance imaging, and conventional X-ray were performed within 2 months before epiduroscopy.

Exclusion criteria were pregnancy, coagulation disorders, glaucoma, malignancy, or allergy to radio-opaque contrast medium, local anaesthetics, steroids, or hyaluronidase, progressive motor disorders, incontinence, and post-surgical pseudomeningocele.

The patients laid prone on an X-ray translucent table with a pillow placed under the pelvis. I.V. access was established and cephazolin 2 g i.v. was administered. No sedation was given in any case. After sterile preparation of the surgical field, fluoroscopy was used to locate L5–S1 space. The skin and underlying tissue was anesthetized with 3–5 ml of lidocaine 2%. A 14 G RX COUDÉ epidural needle (Epimed®, Johnstown, NY, USA) (inner diameter 1.6 mm) was introduced in the L5–S1 space under fluoroscopy control slightly deviated to the side of radiculopathy. The epidural space was identified using the loss-of-resistance method with saline. Needle position was confirmed by X-ray and injection of 6–8 ml of contrast medium (Visipaque 270®, iodixanol, GE Healthcare Bio-Sciences, Spain).

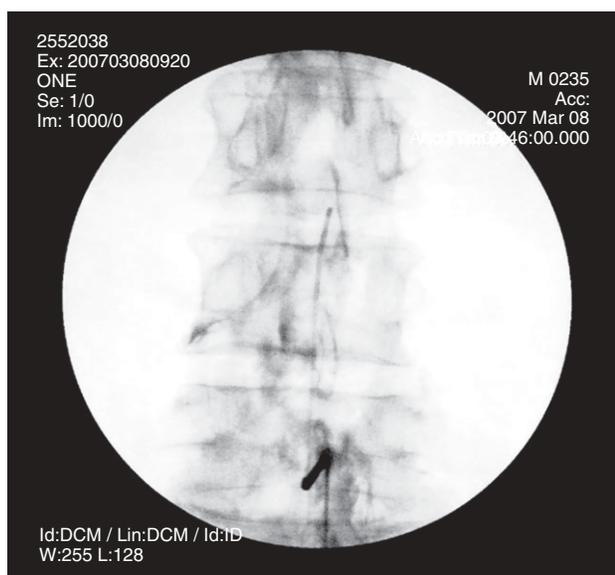
A 0.77 mm flexible fibrescope (PolyScope®, PolyDiagnost GmbH, Pfaffenhofen/Ilm, Germany) 150 cm in length, covered with a 4F angiographic catheter (outer diameter 1.35, inner diameter 0.97 mm; Cordis®, ver 135°, Cordis Corporation, Miami, FL, USA), which was connected to a Y-adapter/haemostasis valve (Merit Medical Systems, UT, USA) for fluid administration (Fig. 1), was introduced via the epidural needle. The endoscopy was advanced under direct vision and fluoroscopy



**Fig 1** The 4F catheter connected to a Y-adapter/haemostasis valve for fluid injection and the fibrescope introduced through them are shown.

control in a cephalad direction. Flushes of normal saline through the catheter (via Y-adapter/haemostasis valve) enabled distension of the epidural space and a good visual field during the procedure. Gentle rotation of the epidural needle and the catheter allowed better field vision. Epiduroscopic findings were recorded continuously by a DVD recorder in each case.

Dorsal and dorsolateral compartments of the epidural space<sup>8</sup> of the affected side were explored at least until the level of pathology in all patients. During the procedure, fluoroscopy control was performed in a 10–20° oblique projection to the explored side in order to obtain better vision of the epidurogram (Fig. 2) with the different nerve roots leaving the spinal canal (when possible). If epiduroscopy showed fibrosis or adhesions at the suspected



**Fig 2** Epidurography (10–15° right oblique projection) showing the lumbar nerve roots and the epiduroscope reaching right L4 nerve root.

nerve root, attempts were made to break adhesions down using saline boluses or by means of the tip of the endoscope. Next, a 6 ml mixture of triamcinolone 40 mg, hyaluronidase 600 IU, and bupivacaine 0.0625% was injected. Other findings, such as size of space (central or lateral stenosis), root atrophy, root inflammation, and arachnoiditis, were also registered. In these cases, the same mixture was administered as near as possible to the nerve root which corresponded to preoperative findings.

When location of the epidural space was not possible at L5–S1 level, the technique was repeated at L4–L5 or L3–L4 level. It was decided to end each procedure 60 min after its start. The total volume of saline was not limited, but when a patient suffered transient neurological symptoms, the procedure was immediately ended. All procedures were ambulatory and were undertaken in the day-stay unit.

Statistical analysis of the VAS results was performed using Friedman's test. Data are expressed as mean (SEM) (range).

## Results

The study population consisted of 19 patients. In all cases, the technique was performed and data were collected (Table 1). Most of them were females (57.9%) and the mean age was 43.5 (33–63) yr. The mean number of operations at lumbar level was 2.26 (1–6). The VAS score was 7.89 (0.19) (7–9) before treatment, 5.00 (0.43) (2–7) 1 month after ( $P<0.001$ ), 5.73 (0.42) (2–8) 2 months after ( $P<0.001$ ), 5.95 (0.44) (2–8) 3 months after ( $P<0.001$ ), and 6.05 (0.46) (2–8) 6 months after the treatment ( $P<0.001$ ). No differences were found between mean VAS values at 3 and 6 months. Mean duration of the procedure was approximately 52 min. The volume of fluid administration was 65 (20–80) ml.

Six patients (31.6%) did not show any improvement 3 months later, and six other patients showed a very significant improvement (at least three points reduction in the VAS) at 3 and 6 months. Seven patients (36.8%) experienced a mild-to-moderate improvement (one or two points reduction in the VAS) (Fig. 3).

Transient neurological symptoms (headache and hypacusia) were recorded in four patients, all of them directly related to the injection of saline boluses. The duration of symptoms was  $<30$  s in all cases, and the procedure was stopped at that moment.

We registered four cases (21%) of dural puncture. These patients were maintained in the day-stay unit at least 6 h. None of them described orthostatic headache and were discharged after being requested to rest at home for 3 days. One patient required admission to the hospital 24 h later with orthostatic headache, which was treated with conventional analgesics, i.v. fluids, and lying flat. He was discharged 5 days later.

Other minor complications encountered were some post-procedure low-back and leg discomfort similar to that

described in conventional epidurolysis. It lasted for 2 days post-procedure and responded to simple oral analgesics.

There were no cases of post-procedure infection.

## Discussion

The aim of this work was to test the feasibility of interlaminar procedure for systematic epiduroscopy and describe our experience in complex patients suffering with FBSS.

This study was not designed for comparing interlaminar approach with conventional caudal technique, but some comments should be made showing major differences between them. For instance, one limitation of our technique is that although rotation movements of the catheter and epidural needle improve our field of vision, it cannot be compared with the 180° steerable tip that other catheters of greater diameter offer. However, in order to obtain a better understanding of the different epidural compartments, we can modify the direction of catheter progress by little movements of rotation of the epidural needle or by making a new epidural access. Using the caudal access, the advance of the catheter is very difficult to modify, in spite of the steering tip, especially when adhesions are present. Moreover, the great diameter reduction of our epiduroscopy technique makes the procedure less painful and allows a better advance of the catheter in patients with fibrosis, stenosis, or both.

In our study, the patients had previously received conventional treatment for FBSS, including epidural steroids and neuroplasty with Racz catheter administering steroids and hyaluronidase, without response. Others include epidural 10% saline in these treatments, but it is not our current practice. The better outcome obtained in some patients with the epiduroscopy technique can be related to direct visualization of the pathological areas, better diagnosis, more accurate lysis of adhesions, and direct application of steroids and hyaluronidase at the site of the pathology.

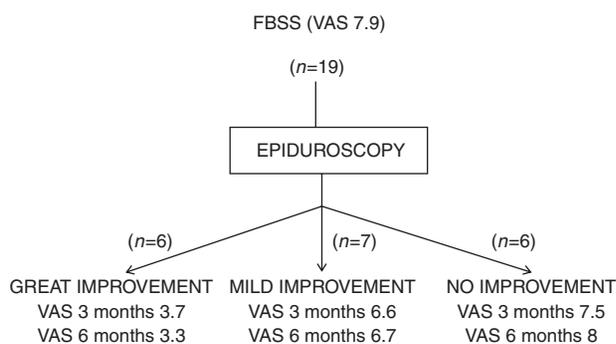
Clinical major findings in our study include the presence of adhesions (Fig. 4), inflammation (fibroinflammatory tissue, nerve root inflammation, and diffuse hyperaemia), stenosis (global or lateral recess), and root hypotrophy.

In cases of arachnoiditis, a typical diffuse inflammation affecting all structures with the presence of some proportion of fibroinflammatory tissue can be observed. But most interesting is the extremely painful response to any kind of manoeuvre such as low-pressure saline injection. Typically, in these patients, there is no significant response to epidural steroids, and palliative treatment must be recommended.

Stenosis is observed as a difficulty in separating duramater of the different structures with fluid infusion. The catheter advances by separating 'two layers', and during withdrawal of the catheter, the layers immediately resume contact. Lateral epidurography usually shows marked

**Table 1** Clinical and diagnostic data of the patients subjected to epiduroscopy. M, male; F, female; L/R: L, left; R, right; PDPH, post-dural puncture headache

Patients no., sex	Age (yr)	VAS (basal)	No. of operations	MRI-outcome L/R	EMG-outcome L/R	Painful segment L/R	Results of epiduroscopy	Duration (min)	Complications and side-effects	VAS (3 months later)	VAS (6 months later)
1. F	47	9	4	Adhesions L5/S1 L. Disc protrusion L4–L5 and L5–S1 L	Severe S1 L radiculopathy. Moderate L5 L radiculopathy	L5/S1 L	Extensive adhesions S1/L5 L and moderate L4 L	55	Accidental spinaloscopy (endoscope). No PDPH	4	3
2. F	45	8	6	Adhesions L4/L5/S1 L L5/S1 R. Arachnoiditis	Moderate L5 RL, S1 R radiculopathy. Severe S1 L radiculopathy	L4/L5/S1 R L	Extensive and strong adhesions L4–S1 RL	50	Accidental spinaloscopy (endoscope) No PDPH	8	8
3. M	37	7	1	Adhesions L5. Disc protrusion L4–L5 R	Mild–moderate L5 R denervation	L5 R	Adhesions L4–S1 R	45	—	3	3
4. F	35	8	1	Adhesions S1 R	Mild–moderate S1 R radiculopathy	S1 R	Adhesions and inflamed S1 R. Adhesions L5 R. Mild adhesions L5/S1 L	50	—	2	2
5. F	43	7	1	Disc protrusion L4–L5 and L5–S1	Normal	S1 R	Fibroinflammatory tissue L5/S1 R. Very painful. Lateral recess stenosis	40	Transient hypoacusia during saline injection	7	8
6. M	44	8	2	Adhesions S1 L	Normal	S1 L	Extensive adhesions L5/S1 L. Hypotrophy S1 L.	55	—	3	3
7. F	63	9	2	Synovial cyst	Moderate S1 RL radiculopathy	S1 RL	Fibroinflammatory tissue. Stenosis	55	—	7	8
8. F	48	8	2	Disc protrusion L5–S1 L. Lateral stenosis	Severe L5/S1 L radiculopathy	S1 L	Extensive hyperaemic adhesions. Painful. Global stenosis	40	—	7	8
9. F	33	8	2	Adhesions L5/S1 L Arachnoiditis	Normal	S1 L	Adhesions. Inflamed L4/L5/S1 L roots. Painful	60	—	7	7
10. F	36	9	1	Adhesions S1 R	Moderate S1 R radiculopathy	S1 R	Mild adhesions. Hypotrophy L5/S1 R. Lateral recess stenosis	60	Transient cephalgia during saline injection	7	7
11. F	43	8	4	Adhesions L5/S1 RL	Moderate L5/S1 RL radiculopathy	L5/S1 RL	Extensive fibrosis L4–S1 RL	60	Dural puncture ×2 (epidural needle). No PDPH	8	8
12. F	40	7	3	Adhesions L5/S1 RL	Moderate L5/S1 R radiculopathy	L5/S1 R	Extensive fibrosis L5/S1 RL	55	Transient cephalgia during saline injection	7	8
13. M	42	7	2	Adhesions L5/S1 R	Severe S1 R radiculopathy	S1 R	Adhesions L4/L5/S1 R. Lateral recess stenosis	55	Dural puncture (epidural needle) PDPH 5 days	7	6
14. M	49	9	1	Modic I changes L4–L5	Moderate S1 R mild S1 L radiculopathy	S1 RL	Fibroinflammatory tissue	50	—	6	5
15. M	54	7	2	Adhesions S1 L	Mild S1 L radiculopathy	S1 L	Adhesions L5/S1 L	40	—	5	5
16. F	42	9	4	Arachnoiditis (?) and oedema L4/L5 R	Very severe radiculopathy L4/L5/S1 R	L4/L5/S1 R	Fibroinflammatory tissue. Inflamed L3/L4/L5/S1 R roots. Very painful	60	—	8	8
17. M	38	7	1	Disc protrusion L5–S1 L. Adhesions S1 L	Moderate S1 L radiculopathy	S1 L	Adhesions L4/L5/S1 L	50	—	5	6
18. M	34	7	2	Disc protrusion L5–S1 L. Adhesions L5 L	Mild S1 L radiculopathy	S1 L	Adhesions L5/S1 L	55	—	4	4
19. F	54	8	2	Adhesions S1 RL. Lateral stenosis	Moderate S1 RL radiculopathy	S1 RL	Adhesions L5/S1 RL	60	Transient cephalgia during saline injection	8	8



**Fig 3** Diagram of the clinical outcome of our patients (FBSS, failed back surgery syndrome; VAS, visual analogue scale score).



**Fig 4** Epiduroscopic view of left L4 nerve root going into an adhesion and scar zone.

narrowing of the posterior epidural space. In these cases, slow volumes of fluid injection can induce transient neurological symptoms, such as headache or hypoacusia. Some authors have described visual impairment and retinal haemorrhage after epidural fluid injections,<sup>9</sup> but we have not found any case in our study. Similar symptoms can be produced in cases of severe epidural fibrosis, which stops cranial or caudal fluid diffusion.

Distension of the epidural space was maintained by saline injections. Fluid was applied discontinuously by the physician in order to administer the lowest volume possible. We did not monitor the epidural pressure, but the relatively high incidence of transient neurological symptoms observed in our patients convinced us to include it in our procedure in the future.

We found four cases of dural puncture. Two of them were produced during catheter advance and the other two

by epidural needle puncture. Surprisingly, only one patient suffered post-dural puncture headache. Perhaps, adhesions, scars, and the saline injected acted to prevent cephalic fluid leakage. We think that dural puncture during catheter advance must be considered as a side-effect during lysis of adhesions.

The most important clinical result of this work is that one-third of the patients had a very significant improvement in the first 3 months after the procedure, which was maintained in the sixth month (Fig. 3). None of them had responded to any of the other treatments. The findings in patients with no positive outcome were related to extensive and strong adhesions, arachnoiditis, or both. These patients were submitted to spinal cord stimulation trial. Other authors have shown better outcomes in their series,<sup>5</sup> but we consider it very difficult to compare small groups with different grades of pathology.

The efficacy of epidural steroids and lysis of epidural adhesions are controversial topics in the treatment of patients with FBSS.<sup>10 11</sup> However, the positive effects of steroids in reducing inflammatory oedema of the injured nerve root, the effect of saline lavage in diluting local tissue concentrations of inflammatory mediators, and mechanical adhesiolysis that could improve blood supply to the root and contribute to better placement of epidural injectates are arguably responsible for the positive outcome in some patients. Targeted epidural medication under epiduroscopy and epidurography control seems to improve outcome, especially in patients with FBSS.<sup>5</sup>

In conclusion, we have described a new procedure for epiduroscopy with a 50% smaller catheter's outer diameter, which allows interlaminar approach without abandoning the diagnostic and therapeutic advantages of the conventional technique. This reduction can be especially interesting in patients with prior lumbar surgery and epidural scars and in cases of lumbar stenosis, making the procedure less aggressive and technically easier. Its diagnostic, and therapeutic, efficacy is clear and helps us to understand the possible causes of pain in patients.

## Acknowledgements

We are grateful to Professor Pilar Zuloaga, PhD, Department of Biostatistics, School of Medicine, Complutense University, Madrid, and Mrs Elena Carreño and Mr Diego Carreño (photography).

## References

- 1 Waldman SD. Epiduraloscopy. In: Waldman SD, ed. *Atlas of Interventional Pain Management*, 2nd Edn. Philadelphia: Saunders, 2004; 568–72
- 2 Slipman CV, Shin CH, Patel RK, et al. Etiologies of failed back surgery syndrome. *Pain Med* 2002; **3**: 200–14
- 3 Schofferman J, Reynolds J, Herzog R, Covington E, Dreyfuss P, O'Neill C. Failed back surgery: etiology and diagnostic evaluation. *Spine J* 2003; **3**: 400–3

- 4 Igarashi T, Hirabayashi Y, Seo N, Saitoh K, Fukuda H, Suzuki H. Lysis of adhesions and epidural injection of steroid/local anaesthetic during epiduroscopy potentially alleviate low back and leg pain in elderly patients with lumbar spinal stenosis. *Br J Anaesth* 2004; **93**: 181–7
- 5 Geurts JW, Kallewaard J-W, Richardson J, Groen GJ. Targeted methylprednisolone acetate/hyaluronidase/clonidine injection after diagnostic epiduroscopy for chronic sciatica: a prospective, 1-year follow-up study. *Reg Anesth Pain Med* 2002; **27**: 343–52
- 6 Dashfield AK, Taylor MB, Cleaver JS, Farrow D. Comparison of caudal steroid epidural with targeted steroid placement during spinal endoscopy for chronic sciatica: a prospective, randomized, double blind trial. *Br J Anaesth* 2005; **94**: 514–9
- 7 Igarashi T, Hirabayashi Y, Shimizu R, Saitoh K, Fukuda H, Suzuki H. The fiberscopic findings of the epidural space in pregnant women. *Anesthesiology* 2000; **92**: 1631–6
- 8 Savolaine ER, Pandya JB, Greenblatt SH, Conover SR. Anatomy of the human lumbar epidural space: new insights using CT-epidurography. *Anesthesiology* 1988; **68**: 217–20
- 9 Gill JB, Heavner JE. Visual impairment following epidural fluid injections and epiduroscopy: a review. *Pain Med* 2005; **6**: 367–74
- 10 Koes BV, Scholten RP, Mens JM, Bouter LM. Efficacy of epidural steroid injections for low-back pain and sciatica: a systematic review of randomized clinical trials. *Pain* 1995; **63**: 279–88
- 11 Watts RW, Silagy CA. A meta-analysis of the efficacy of epidural corticosteroids in the treatment of sciatica. *Anaesth Intensive Care* 1995; **23**: 564–9