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Lumbar epidural perineural injection: a new technique

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Abstract Two controlled studies for a new epidural, perineural, single-shot, selective nerve root injection with a double-needle approach to the anterior epidural space of the lumbar spinal canal are presented. The results were analysed to determine the effectiveness of the new epidural perineural injection technique. The trial comprised two controlled studies on 182 patients. One study compared prospectively randomized results of patients with lumbar radicular syndromes who received epidural perineural injections ($n = 47$), conventional posterior epidural injections ($n = 40$) and, as a control group, paravertebral local anaesthetic ($n = 46$). A second, prospective, double-blind study compared the effect of epidural perineural injections with triamcinolone ($n = 24$) and pure saline ($n = 25$). Epidural perineural

injections were more effective than conventional posterior epidural injections. Both epidural groups had better results than the paravertebral local injection group. Epidural perineural injections with steroids (10 mg triamcinolone) were more effective than saline alone. A systemic steroid effect was excluded by additional intramuscular steroid injections in the saline group. There were no severe complications or side effects in any of the three groups. The studies concluded that single-shot epidural perineural injection is effective in the treatment of lumbar radicular pain. It is a “one drop only” therapy to the source of pain.

Key words Epidural perineural injection · Local injection therapy · Lumbar radicular syndrome · Conservative treatment

Introduction

The effectiveness of epidural steroids in the treatment of symptoms of lumbar nerve root compression remains controversial [1, 2, 6, 7, 9, 12–16]. One reason for different results and ineffectiveness may be the fact that the steroids do not reach the appropriate nerve root in a sufficient concentration by conventional caudal or posterior injection techniques.

Unfortunately, liquids flow along the route of least resistance, which is likely to be away from the area one wishes to block [8]. We performed conventional midline posterior epidural injections with contrast medium (Solu-

trast 250) followed by CT (Fig. 1). The injected fluid with contrast was found mainly in the posterior epidural space, only a small fraction reached the affected transversing and exiting nerve root on one side of the anterior epidural space. High doses of steroids and a large amount of fluid are necessary to reach the area of interest in the right or left side of the anterior epidural space, where the nerve root is compressed by disc protrusions or bony deformations in the lateral recess. It seems more reasonable to inject the medication directly into the anterolateral corner of the epidural space.

Fig. 1A, B CT after conventional posterior epidural injection at L4/5 with contrast medium (Solutrast 250) (A). The contrast medium is seen mainly in the posterior epidural space (arrow) (B). **A** Before; **B** after injection of contrast medium

Epidural perineural injection: technique

Over the past 4 years we have used a new oblique interlaminar approach with a thin 29-G spinal needle inserted into the anterior epidural space in order to reach the involved nerve root on one side directly.

For the epidural perineural injection, the patient sits with a lumbar kyphotic posture. The introducer needle for passing skin and interspinous ligaments is inserted 1 cm below and 2 cm contralateral, with an angle of 30°–45° to the midline. The 29-G needle then passes the ligamentum flavum and ends up in the lateral part of the anterior epidural space, which is recognized by bony contact. At this moment, about 20% of patients have a slight reproduction of their pain. Only a small amount of medication (1 ccm local anaesthetic, 10 mg triamcinolone) is necessary for this injection. Before and during the procedure it is helpful to have a look at the anteroposterior plain radiograph of the lumbar spine in order to find the right approach through the interlaminar window. For educational reasons, for scientific documentation (Fig. 2) or difficult

cases with postoperative epidural scars, and for the individual learning curve, CT-controlled epidural perineural injection technique may be indicated. Imaging is not used routinely, because like in spinal or peridural anaesthesia, with some training it is possible to find a route through the interlaminar window into the spinal canal. The level – usually L4/5 or L5/S1 – is determined by palpation of the spinous processes and the iliac crest.

Our experience of this new epidural approach in over 600 cases over 3 years with good results and no severe complications indicates the need for a well-constructed study to recommend this method for common use.

Materials and methods

The trial included 182 hospitalized patients with intractable sciatica. The essentials of the study were explained to the patients. Inclusion criteria for all groups were based on the well-known signs of single lumbar nerve root compression. The entry data were root pain exemplified by unilateral sciatica extending below the knee and associated with paraesthesia and tension signs in the form of a positive straight leg raise (SLR), limited movement of the trunk

Fig. 2A, B Epidural perineural injection with double-needle technique for selective epidural nerve root infiltration (arrow) with circular demarcation of the S1 nerve root. **A** Schematic representation. **B** CT scan after injection showing contrast medium around the nerve root

Fig. 3 CT-guided epidural perineural injection

and aggravation of pain by certain movements and coughing. Paraesthesia, reflex changes and muscle weakness were registered. Predominant symptom prior to injection was leg pain rather than back pain. Patients were excluded if they had other concomitant diseases like osteoporosis, diabetes or contraindications for steroids.

In the case of cauda symptoms and paralysis by disc herniations, microdisctomy was performed immediately. Before entering the study, patients underwent routine blood analysis and CT and/or MRI with confirmed pathology. All patients had disc protrusions with nerve root compression signs. Besides the injections, all patients had physiotherapy, back school and a dynamic flexion orthosis (Discoflex) to relieve the load on the posterior part of the lumbar disc.

At baseline there was no statistically significant difference between the groups concerning age, sex, duration of symptoms or compression signs. Most of the patients in all groups remained in the trial because of some kind of improvement. There were eight drop-outs because the patients did not want more injections. One patient had a tumor.

Epidural perineural versus epidural conventional

The first trial was a prospective randomized study to compare the new epidural perineural injection (47 patients) and the conventional epidural injection technique (40 patients). Both were compared to a third group, which received a paravertebral local anaesthetic injection (46 patients). The study procedure involved three injections in 1 week.

Assessments, both subjective and objective, were made before treatment – at baseline – and again at 3 weeks and 3 months. Subjective assessment included a specific symptomatology questionnaire from our spine group [12, 13] to determine any effects on the patient's lifestyle and degree of back and leg pain. Following successful injections leg pain showed the most dramatic improvement. Objective analysis was made by recording the angle of SLR, bending forwards and neurological signs. Results – subjective and objective – were scored and summarized in four groups: 1 = good, 2 = fair, 3 = poor, 4 = surgery. The follow-up investigations were carried out by an unbiased investigator. A clinical investigation was performed and the patients graded their average back and leg

pain on a 1–10 visual analogue scale (0 = no pain to 10 = worst imaginable pain). The results were assessed according to the following modified MacNab criteria:

Good

Leg pain less than 10%
Back pain less than 20%
Returned to same work
Sports as before

Fair

Leg and back pain less than 50%
Returned to reduced work
Returned to reduced sports
SLR (+)

Poor/surgery

Same pain
Unable to work
Unable to do sports
SLR+

Epidural perineural: steroid versus saline

The second trial was a prospective double-blind study comparing the epidural perineural injection of 10 mg Triamcinolone with saline (24 patients) to saline alone (25 patients). Neither patient nor doctor was aware of the injection content. Because steroids can easily be identified by colour all syringes were covered in sterile tape. All injections were performed by the same doctor. To get the patient's consent for a potential saline injection alone was not very difficult, because there had been some reports about the success of epidural saline in sciatica [3, 11, 17]. Any potential systemic steroid effect was excluded by giving the saline patient group the same triamcinolone dose by intramuscular injection. There were no side effects and complications, so that the patients of all groups could take part in the physiotherapy programme. Study procedure and assessments for the second study were the same as for the first study. If patients did not sufficiently improve, they received epidural perineural injections containing triamcinolone.

Results

The first study included 133 patients, the second study 49. There was no significant difference in the average duration of symptoms and clinical data before admission to the study for all groups. The group given epidural perineural injections (Fig. 4) had a significantly better outcome than the conventional epidural group: 68% had excellent or good results, 22% fair. Of the six patients who did not improve at all, four had surgery. In the conventional epidural group 53.3% had excellent or good results. Seven patients had open surgery in the end.

Both epidural groups had a significantly better outcome than the control group, where 65.2% were unchanged. Six control patients had open surgery.

The double-blind study to compare epidural perineural injections with and without steroids showed better results in the steroid group. The outcome of patients given epidural perineural injections with triamcinolone was comparable to the results in study one (Fig. 5).

Except for some surgical cases, we did not routinely use CT or MRI when patients improved, for financial reasons.

Adverse effects

No major side effects were reported in any group. There were no infections. We registered an overall headache rate of 1.9% with epidural perineural injections, and with conventional epidural injections 3.6%. Headache in the paravertebral control group was below 1%.

Fig. 4 Results of the epidural perineural injection group, the conventional epidural posterior injection group and the paravertebral local anaesthetic control group ($n = 133$)

Fig. 5 Results of the double-blind study to compare epidural perineural injection with triamcinolone and saline ($n = 49$)

Potentially nerve roots can be damaged by the block needle; however, we encountered no permanent injuries. All patients who had epidural perineural injections followed by open surgery, which we routinely perform by microdiscectomy using a microscope, did not show any nerve root damage or other epidural lesion. In some cases we found small plaques of steroid carrier residue in the epidural fat, without any surrounding tissue reactions. Most of the microsurgical disc operations were performed by the senior author.

Discussion

This group of 182 patients with the clinical syndrome of persistent lumbosciatic pain is a significant population in which to evaluate the success of a special treatment like the new epidural perineural injection. The new element in the technique is the application of steroids and local anaesthetics through an oblique interlaminar approach to the nerve root into the anterior epidural space. Epidural steroids are effective in the treatment of lumbar radicular pain. Our two controlled studies confirm the results of Bush and Hillier [6] who performed a controlled study of caudal epidural injections with triamcinolone for intractable sciatica.

If the source of pain is suspected to lie in one segment on one side an epidural perineural injection is even more effective than a conventional interlaminar epidural injection, which reaches primarily only the posterior epidural space. The epidural perineural technique requires less steroid and local anaesthetic to have the same effect as the conventional technique. To insert the thin 29-G needle into the anterior epidural space, a double-needle approach with an introducer is necessary to pass rigid posterior structures such as, for example, the posterior interspinous

ligament. The epidural perineural technique without imaging control needs some training with a learning curve. This may be the reason why the percentage of good results in the second trial (epidural perineural versus conventional) is higher (68%) than in the first trial (epidural perineural steroid versus saline), with 54% good results when we started with this new technique.

The better outcome of epidural saline compared to a paravertebral local anaesthetic injection may be due to the fact that the introduction of a fluid into the epidural space washes out the inflammation mediators, especially when an epidural perineural approach is used. The injection of normal saline into the epidural space has also been suggested by other authors [3, 11]. The addition of a powerful steroid such as triamcinolone optimizes this effect.

Adverse effects of the new epidural perineural injection technique are lower than with the conventional tech-

nique. Postinjectional headaches because of dura puncture were less frequent, and less severe when they happened. Inadvertent dura puncture with a 21-G needle, which is necessary for the loss of resistance technique, obviously leads to more cerebrospinal fluid leakage than with a 29-G needle, which is used for the epidural perineural technique.

Although all injections were performed on inpatients, the epidural perineural injection is also suitable, with the proper precautions, for outpatients.

Conclusion

Single-shot epidural perineural injection has a good effect on lumbar radicular syndrome with a reasonable LIRCE factor [13]: Low Invasivity, Risk, Cost but Effectivity.

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