

Spinal epidural for lumbar and lower extremity pain – a brief summary

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Medication was first injected into the epidural space to treat lumbar and lower extremity pain in the early part of the last century. Viner began injecting large volumes of saline and procaine into the lumbar epidural space in the 1920s¹; this work was continued by Evans in the 1930s². The effects of epidural steroid injection were first reported by Brown³ in the 1960s. Epidural injection of corticosteroids is now one of the most commonly used non-surgical interventions for the management of chronic spinal and lower extremity pain. However, debate continues regarding the value of this intervention. The evidence for effectiveness is highly variable among studies; this is further complicated by the fact that three separate approaches are described in the literature (caudal, transforaminal and interlaminar).

The interlaminar entry procedure, which more closely targets the assumed site of the pathology, requires less volume of medication than the caudal procedure. The caudal approach requires a higher volume of injected material (10–20ml) to reach the site of pathology but is achieved relatively easily with minimal risk of inadvertent dural puncture. The transforaminal approach requires the smallest volume of injected material to reach the anterior–lateral root ganglion, its primary site of pathology.

Indications

- ◆ **Prolapsed intervertebral discs and annular tears**
Epidural injections are not indicated for large disc protrusions where a more urgent surgical opinion is required.
- ◆ **Spinal stenosis**
- ◆ **Foraminal stenosis** can be more helpfully treated using nerve root blocks.
- ◆ **Spondylolisthesis**

The injection process

A spinal epidural involves the introduction of a needle through the ligamentous tissue of the spine and into the space outside the dura; a fine catheter is introduced through the needle into this space, the needle is removed and the catheter is taped securely to the skin and steroid or anaesthetic can be introduced through the catheter for a period of time.

Epidural injections can be delivered for a number of reasons, but the most common is for the relief of nerve root pain; the injection mixture commonly used is 20ml of solution containing 40mg of triamcinolone and 0.5% lignocaine. The triamcinolone exerts an anti-inflammatory effect and the lignocaine produces a local anaesthetic effect and attempts to make the procedure less uncomfortable. Lignocaine can cause mild numbness in the buttocks and legs for up to two hours after the procedure, but does not cause any leg weakness or interference with walking. This is generally assessed before discharge⁴.

Epidurals can be delivered at different levels, depending on the nerve roots involved.

Caudal epidurals can be given for nerve root irritation between L4 and S4
Lumbar epidurals can be given for nerve root irritation between L1 and L5

Technical information

Caudal epidural

The patient is usually prone with a pillow under the hips to provide support; the epidural space is more easily accessed through the sacral hiatus. The epidural mixture, usually 20ml of solution, is injected slowly at a rate of 1–2ml at a time with short pauses in between. The injection takes about five minutes to deliver. Some patients report a feeling of sciatica being produced, while others feel a sensation of mild pressure which builds during the injection and falls during the pauses.

Lumbar epidural

This is performed under X-ray screening with the patient positioned on their left side. Intravenous sedation is usually administered through an intravenous cannula. The epidural needle is inserted between the spinous processes into the epidural space to a depth of between 3 and 11cm (average 5cm); the space is identified by the loss of resistance to an air-filled syringe. The epidural solution is slowly injected after confirmation of the correct needle position using an Epidurogram. Following the procedure, the patient is usually positioned for two hours with their affected side down to encourage the spread of the epidural mixture to the affected nerve root⁵.

Mechanism

The underlying mechanism of action of steroid and anaesthetic administered via an epidural route is still not clearly understood. Lindahl and Rexed first noted inflammation, oedema and proliferative or degenerative changes in biopsy samples from posterior nerve roots of patients undergoing laminectomy⁶. Berg, using myelography, observed a consistent reduction in the swelling of affected nerve roots coincident with an improvement in reported sciatic symptoms⁷. Abdi *et al*⁸ report that it is believed that the neural blockade obtained alters or interrupts nociceptive input, reflex mechanisms of the afferent fibres, self-sustaining activity of the neurons and the pattern of central neuronal activities. Further, it is believed that local anaesthetic interrupts the pain–spasm cycle and reverberating nociceptor transmission. Corticosteroids, on the other hand, reduce inflammation by inhibiting either the synthesis or release of a number of pro-inflammatory mediators and by causing a reversible local anaesthetic effect.

Factors affecting outcome A small number of studies have tried to identify factors that could affect the outcome of spinal epidural. These include:

- ◆ a large number of previous treatments for pain⁹
- ◆ high dependence on pain control medication(s)⁹
- ◆ pain not increased with activity⁹
- ◆ pain increased by cough⁹
- ◆ ongoing lack of employment (predicted poor long term result)⁹
- ◆ lack of employment at the start of treatment¹⁰
- ◆ smoker¹⁰
- ◆ presence of chronic or non-radicular pain symptoms¹⁰
- ◆ blind needle placement by specialist (i.e. without fluoroscopic control)^{11,12}
- ◆ insufficient delivery of steroids¹³

Evidence of complications following the procedure

Side effects of epidurals are reported to be relatively minor and reports on thousands of patients suggest that the procedure is relatively straightforward and safe¹⁴.

Documented reactions to the procedure can be classified simplistically into early and late complications.

Side effects and early complications (while the injection is being performed or just	Estimated frequency (cases per spinal epidural injection) where known
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after)	
Mild numbness and tingling lasting 2 hours or less	
Pain exacerbation for up to 24 hours after the procedure	
Difficulty in passing urine for a short time after the procedure	1 in 200 ⁵
Menstrual irregularity or unexpected post-menopausal bleeding	
Post dural puncture headache (PDPH) can last between 1 and 2 weeks	
Dural puncture	Between 1–3% of all epidurals carried out ⁵
Total spinal injection	
Nerve damage through direct injury	1 in 10,000 to 1 in 30,000 ⁴
Nerve damage through haematoma	1 in 150,000 to 1 in 220,000 ⁴
Nerve damage through infection or inadequate blood supply	1 in 100,000 to 1 in 150,000 ⁴
Seizure can occur; 10% of all epidural injections may be placed in the rich supply of veins in the epidural space	
Anaphylaxis	Rare ⁵

Late complications

Lack of pain relief	
Increased pain	
Salt and water retention	
Spinal haemorrhage	
Spinal abscess formation	
Nerve damage causing permanent paralysis of both legs and/or loss of bladder and bowel control	Very rare ⁴

Reviewing the evidence

Evaluating the evidence for the use of steroid injections is a difficult undertaking. A Cochrane review was carried out in 2000¹⁵ which evaluated 21 randomised trials of all types of spinal injection therapy for low back pain and showed a leaning towards a positive effect, although this benefit was not supported by unequivocal evidence. Only four randomised placebo-controlled trials of epidural injection were of sufficiently high quality to be considered in this review¹⁶. All four studies reported pain relief in more patients with active treatment compared with placebo; this benefit was not, however, conclusive when the data was pooled.

Clinical studies in this area considered by systematic review have identified a number of features which have created evaluation difficulties¹⁷. These features include:

- ◆ lax treatment protocols using a variety of concurrent therapies in addition to epidural steroids;
- ◆ lack of uniform outcome measures and objective measures;
- ◆ lack of suitable controls;
- ◆ few randomised, prospective or blinded studies;
- ◆ failure to standardise the dose, delivery methods and inclusion of local anaesthetic within a single treatment group;

The most recent systematic review⁸ examined a number of features of clinical studies and these are summarised below:

Procedure	Number of studies identified	Level of evidence	Cost-effectiveness
Interlaminar epidural injections	62	Strong level of evidence for short-term relief and limited for long-term relief. Indeterminate evidence for axial low back pain and lumbar spinal stenosis	Two authors ^{18,19} concluded that this is not cost-effective
Transforaminal epidural injections	86	Strong level of evidence for short term relief in the management of lumbar nerve root pain, and moderate for long-term improvement. There is limited evidence for managing lumbar radicular pain in postlumbar laminectomy, and indeterminate evidence in managing axial low back pain and lumbar disc extrusions.	The cost per one-year improvement of quality of life was shown to be \$2,927 in one study ¹⁸ . The cost of avoiding operations by containing herniations through this procedure was also estimated to be \$12,666 less per responder in the steroid group ²⁰ .
Caudal epidural injections	24	There is strong evidence for short-term relief and moderate for long-term relief in managing chronic pain of lumbar radiculopathy and postlumbar laminectomy syndrome. The evidence is moderate in managing chronic low back pain for short-term and long-term improvement.	For fluoroscopically-directed caudal epidural steroids, cost-effectiveness was shown to be \$3,635 per year. The cost for one-year improvement of quality of life was \$2,550 in patients treated with caudal epidural with local anaesthetic and Sarapin or steroids under fluoroscopy ²¹ .

Levels of evidence are designated in the table above and can be described:

Level I	Conclusive: research-based evidence with multiple relevant and high quality scientific studies or consistent reviews or meta-analyses
Level II	Strong: Research-based evidence for at least one properly designed randomised controlled trial, or research-based evidence from multiple properly designed studies of smaller size, or multiple low quality trials
Level III	Moderate: <ul style="list-style-type: none"> a) Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method) b) Evidence obtained from comparative studies with concurrent controls and allocation not randomised (cohort studies, case-controlled studies or interrupted time series with a control group) c) Evidence obtained from comparative studies with historical control, 2 or more single-arm studies, or interrupted time series without a parallel group control group.
Level IV	Limited: Evidence from well-designed non-experimental studies from more than one centre or

	research group, or conflicting evidence with inconsistent findings in multiple trials
Level V	Indeterminate: Opinions of respected authorities based on clinical evidence, descriptive studies or reports of expert committees

Need for further evidence.

Researchers who have investigated this area are of the same view that further high quality clinical studies with appropriately large sample sizes must be carried out to gain equivocal evidence for the use of steroid epidurals. A Cochrane review looking at the use of epidural steroids for radicular back pain. (www.cochrane.org/reviews) is due to be completed in 2007.

Sources of further information

Royal College of Anaesthetists: www.rcoa.ac.uk.

The Pain Clinic: www.painclinic.org/treatment-epiduralinjections.htm

World Anaesthesia Online: www.nda.ox.ac.uk.

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