Epidural steroid injection for sciatica: An analysis of 526 consecutive cases with measurements and the whistle test

Tony TT Loy
Consultant Orthopaedic Surgeon, St. Paul’s Hospital, Causeway Bay, Hong Kong.

ABSTRACT

The effects of epidural injections of triamcinolone acetonide and bupivacaine in the treatment of sciatica were analyzed in a retrospective series of 526 consecutive cases with measurements. A new test (the whistle test) is described. There is a paucity of measurable parameters in reports on the subject in the literature, and many are not specific or symptom-oriented to sciatica. The procedure was performed by the same operator and reviewed one week postoperatively with measurements. 491 patients (93.35%) achieved excellent to good pain relief, backed by appropriate increases of straight-leg-raise measurements. But 17 patients (3.46%) of this group required surgery later. It is concluded that epidural steroid injection is a simple, cost-effective and minimally invasive treatment for sciatica, especially in the acute. It also serves as a method for crisis intervention and as a prognosticator.

Key words: sciatica, epidural steroid, whistle test, rapid relief, cost-effective

INTRODUCTION

The treatment of sciatica by epidural steroid injection was reported in 1953 by Lievre. It has since been used widely in many countries and all continents with varying success as reported in the United Kingdom, America, India, Australia, New Zealand and Europe. It has also been included as an often-used orthodox therapy in an orthopaedic text of the gold standard class. The most dreaded complication was epidural abscess and localized infection of various forms, whereas complications such as meningitis and arachnoiditis occurred rarely and only in subdural injections or not at all. Other rare forms such as retinal hemorrhage, myopathy and lipomatosis associated with Cushing's syndrome have also been reported.

The present paper is aimed to present a single operator's experience with measurable parameters (straight leg raising test, spinal flexion and extension, percentage of improvement), which is believed to be uncommon in the literature. A new test, the Whistle Test, is also described.

Sciatica is basically a nerve entrapment syndrome. As such, a local epidural steroid injection will reduce the soft tissue swelling, oedema, pressure,
inflammation and soft adhesions on the nerve trunk as local steroid injections would do in other entrapment syndromes like carpal tunnel syndrome or ulnar tunnel syndrome. It is also subjected to the same limitations as in these sites. Low back pain was regarded as a more complex problem and cases were thus not included in this study.

As compared with the recently developed percutaneous disc injections (e.g. chymopapain chemonucleolysis) and discectomy procedures (e.g. arthroscopic, epiduroscopic, laparoscopic, laser discectomy), epidural steroid injection has the advantages of simplicity, cost-effectiveness, minimal invasion and early relief of symptoms.

MATERIALS AND METHODS

The aim was to deliver an aliquot of a small, adequate and precise dose of the appropriate medication, in the correct quality, quantity and concentration, to the site required or as near as possible. It was judged important that the exact level of nerve compression, as decided after clinical and radiological examination, was injected. The L3/4 route, being rarely the level of impingement (95% of lumbar disc protrusions were at the L4/5 level), and the caudal route both required a large volume of fluid injection to reach the affected site and were therefore not used.

The patient was placed in the lateral decubitus foetal position with the hands holding the knees, lying on the side of the sciatica. Under full aseptic technique, the pre-determined disc level was again located by surface anatomy. No fluoroscopy was used. 2,8,43 2 c.c. of 0.5% bupivacaine hydrochloride (Marcain) was infiltrated to the skin and subcutaneous tissues. An 18 gauge Tuohy type epidural needle (1.3 x 80 mm or 1.2 x 80 mm, either disposable or re-usable) was inserted at the midline of the back of the selected site with the bevel upwards and stylet in position. After the ligamentum flavum was pierced, a 5 cc glass syringe, the inside lubricated with 0.25 to 0.5 c.c. of 0.5% bupivacaine, was attached to the Tuohy needle after stylet removal. The needle was advanced slowly and tests for ‘loss of resistance’ were carried out at intervals. After the ligamentum flavum was pierced, the epidural space was entered and a positive ‘loss of resistance’ test was carried out. The major cause of generation of a negative pressure or a loss of resistance was the effect of ‘coning’ of the dura by the advancing needle point.

An ‘air injection test’ was then applied. This involved warning the patient first, and then 2–3 cc of air with a little bupivacaine left in the barrel was rapidly injected into the epidural space with the bupivacaine-lubricated glass syringe. This further confirmed that the epidural space (a potential space) was entered. The patient might then cry out or wince as the sciatica was reproduced, signifying the correct placement of the needle point and that the nerve root was sensitive to the increase of pressure.

The Whistle Test

The Whistle Test started when 2–3 cc of air was injected with the air-injection test. The syringe was then disconnected from the needle. At this time, injected air in the epidural space gushed back through the nozzle of the epidural needle, moistened with bupivacaine, and producing a hissing whistle. The term ‘Whistle Test’ was coined for this phenomenon, which is believed not to have been described previously in the literature. This was a reproducible and repeatable test, and if positive, was a final confirmation of the correct placement of the needle, which was essential for a successful procedure. This was due to the fact that the epidural space was a potential space normally kept closed by the existing combined tissue pressures of the cerebro-spinal fluid, intradural pressure, respiration and the arterial pulse pressure. This space was forced open by the air injection. As soon as the syringe was removed, the tissue pressure would force the engorged air out through the epidural needle nozzle, which, wetted with a small amount of bupivacaine, produced a characteristic whistle. The tone of the whistle was remarkably constant, though the exact pitch has not been determined as yet. The Whistle Test would be negative if the needle point was subdural, as the cerebro-spinal fluid rather than air would gush out. It would also be negative if the needle point was in the paravertebral tissue, as air will be difficult to be injected (with no loss of resistance) and even if injected inappropriately, would disperse rather than become pent-up and be pressed out. A visible bulge could be observed in the paraspinal area of the back except in the very obese. The Whistle Test was clearly positive in almost all the cases in the present series. A better whistle was produced in the all-metal epidural Tuohy needles as compared with the disposable ones with plastic rear fittings.

After the tests, 3 cc of 0.5% bupivacaine with 3 cc of triamcinolone acetonide (Kenacort A IA) were injected into the epidural space, with the nozzle of the epidural needle either remaining upwards or turned 180° downwards to face the affected nerve. The needle was quickly withdrawn and the injection site dressed. The patient was allowed to lie in a lateral position for a few moments and then transferred back to the ward.
in a supine position. The procedure, from transfer of the patient in to out, averaged 15 minutes operating room time. The patient could choose to rest lying for a few hours in the hospital before discharge or go home with an escort as an outpatient. In the immediate post-operative hour, the patient might experience temporary paraesthesia of the affected leg, and at times both legs, from the bupivacaine. Review was carried out at one week postoperatively and physical examination with measurements done again. The patient’s subjective response was also recorded.

RESULTS

From June 1988 to June 1994, 526 consecutive cases of epidural steroid injection for the treatment of sciatica were included in the present reported series. All the procedures were performed by the same operator (TTL) in St. Paul’s Hospital, Hong Kong using a standardized full aseptic technique in the operating room. All were private patients and workers-compensation cases numbered less than 1%. Only one epidural injection was given to each patient and the procedure was not repeated for the same episode.

All patients had preoperative physical examination, measurements, plain radiological examination performed, and for the indicated, haematological tests as well. Inflammatory, infective and neoplastic conditions were excluded. The pre-dominant nerve root involved giving rise to sciatica symptoms was determined on clinical evidence and plain radiological findings. Gradings were recorded for pre-operative pain, parasthesia, and weakness, and measurements taken for ipsi-lateral and contra-lateral straight leg raising tests, and spinal motion (flexion and extension). One week post-operatively, the patient was reviewed and the same parameters were recorded for comparison and analysis. Pain and paraesthesia improvements expressed in percentages, as subjectively judged by patients, were also noted.

The patients ages ranged from 19 to 88 years, with a mean of 46 years. There were 231 female patients and 295 male patients. The duration of preoperative symptoms was from less than one to 200 weeks, the mean being 15 weeks. Patients with symptoms less than 3 weeks of onset were regarded as acute (183/526, i.e. 35%) and the rest (343/526, i.e. 65%) were chronic. Occupations of the patients were sedentary 39% (204/526), manual labouring 32% (167/526) and housework 29% (155/526).

The pre-dominant nerve root involved was the L5 root 89% (468/526). S1 root was involved in 9% (45/526) and indeterminant 2% (13/526). This was determined on clinical grounds with plain radiological confirmation. CAT scans, MRIs, myelograms, epidurograms, discograms, etc. were taken into account if available but were not primarily sought. Symptom-wise, preoperative pain was classified into mild (Grade 1, 0 cases), moderate (Grade 2, 326 cases = 61.6%), and severe (Grade 3, 202 cases = 38.4%). Preoperative paraesthesia was recorded as nil (Grade 0, 448 cases = 85.17%), mild (Grade 1, 4 cases = 6.76%), moderate (Grade 2, 66 cases = 12.55%), severe (Grade 3, 8 cases = 1.52%). Preoperative treatment included medication in 322 cases, physical therapy in 68 cases and others.

ANALYSIS

1. Complications. Complications occurred in 9 cases (1.7%). All were accidental intra-dural punctures and not injections. Most had temporary headaches responding to bedrest, oral fluids and paracetamol.
2. Spinal motion improvements. Increase of spinal flexion was recorded from 0° to 70°, with a mean increase of 32°. Extension increase ranged from 0° to 30°, with a mean increase of 11°.
3. Parasthesia improvement. 59 out of 78 cases (75.64%) with paraesthesia had symptomatic improvement.
4. Post-operative muscle weakness improvement. A total of 12 cases of muscle weakness (extensor hallucis longus for L5 root or flexor hallucis longus for S1 root) were present. No improvement was recorded. Five out of the 12 cases eventually needed surgery.
5. Post-operative ipsi-lateral (affected side) and contra-lateral SLR increase. The results are presented in Tables 1 and 2. The percentage of increase (actual increase in degrees/normal SLR of the particular patient) is more relevant due to individual SLR variations. The mean increase of ipsi-lateral SLR was 29% (24°).
6. Pain improvement. The results were divided into 4 groups. 491/526 cases (93.35%) were in the good and excellent categories, but even then, 17/491 cases (3.46%) in this group required surgery later (Table 3).
7. Additional treatments prescribed at one week post-operation. Muscle relaxants were given in 221 cases, nothing more in 132 cases, surgical corsets in 75 cases, physical therapy in 70 cases, NSAIDs in 3 cases. Surgery was required in 33 cases, and these were regarded as failures in the assessment of the efficacy of the procedure.
8. **Sick leave following procedure.** The range was from 0 to 30 days, averaging 4 days.

9. **Return to regular sports.** Of the 41 cases who had taken part in pre-operative, regular sports, return was recorded at a range of 0 to 4 weeks, with a mean of 2.3 weeks.

**DISCUSSION**

It has been said, ‘When you can measure what you are speaking about, and express it in numbers, you know something about it’. They introduced to the author early in his training in orthopaedic surgery by the late Professor A.R. Hodgson. An attempt was thus made to apply this concept to the common problem of sciatica, as a symptom-related study, with a few measurable parameters. Most of the reports in the literature were either ‘mixed bags’ of intra and extra durals, sciatica with back pain and spinal stenosis; measurable parameters were few.

The treatment of epidural steroid injection in sciatica is by no means a permanent cure, though quite a few patients had no more recurrences in their lifetime. Only spinal fusion operations can claim permanency in their effects.

The issue of the short follow-up of one week calls for some clarification. All 526 cases were private practice patients. As the effects of the steroid injection were to be felt a few days after the procedure, one week post-operative follow-up assessment was deemed mandatory. A second follow-up assessment after a further three weeks (four weeks post-operation) was suggested if symptoms remained worrisome to patients; this was on a patient-initiated demand basis, was not enforced and thus not included in this study.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Preoperative ipsilateral SLR test status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLR range in degrees</td>
<td>Number of patients</td>
</tr>
<tr>
<td>SLR 15°–30°</td>
<td>110</td>
</tr>
<tr>
<td>SLR 35°–60°</td>
<td>288</td>
</tr>
<tr>
<td>SLR 65°–90°</td>
<td>128</td>
</tr>
<tr>
<td>SLR Mean = 53°</td>
<td></td>
</tr>
<tr>
<td>Positive Lasègue Sign = 447 patients (84.98%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Postoperative improvement in straight leg raising test in all groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipsilateral SLR increase in degrees</td>
<td>Ipsilateral SLR increase in range in %</td>
</tr>
<tr>
<td>Range</td>
<td>0°–60°</td>
</tr>
<tr>
<td>Mean</td>
<td>24°</td>
</tr>
</tbody>
</table>

Percentage of SLR increase = postop increase in SLR/contralateral postop SL (taken as normal for patient)

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Postoperative pain improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement in groups</td>
<td>% of pain improvement</td>
</tr>
<tr>
<td>Group 1 — Poor</td>
<td>0–25%</td>
</tr>
<tr>
<td>Group 2 — Moderate</td>
<td>26–50%</td>
</tr>
<tr>
<td>Group 3 — Good</td>
<td>51–75%</td>
</tr>
<tr>
<td>Group 4 — Excellent</td>
<td>76–100%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>
Even then, a very small number of patients (less than 0.5%) did default on the one week post-operative follow-up visits and were therefore excluded in the present series. They were usually picked up subsequently when presenting with a different pathology years later.

A longer follow-up, e.g. six months, may indeed add to the information gained. However, the nature of the procedure catered more towards crisis intervention and rapid relief of acute symptoms. It was also felt that non-compliance would be high if patients were requested to return 6 months later, especially if they were symptom free. Thus a longer follow-up was not practised on a regular basis.

CONCLUSION

1. Epidural steroid injection is a simple, cost-effective and minimally invasive treatment for sciatica, especially in the acute cases 6,23,25.
2. The site, route, and volume of medication given should be direct, specific and appropriate. One correct injection would suffice.
3. The complications are negligible and temporary.
4. It is highly useful in patients who desire quick relief or whose circumstances dictate so (crisis intervention)25.
5. It also serves as a ‘water-shed’ procedure and a prognosticator. Patients with poor response will most likely require surgical solutions 42 as these indicate severe mechanical compression beyond local inflammation, swelling, oedema and adhesions.
6. A new test, the Whistle Test, is described. It is felt that the spinal surgeons who treat the patients, perform surgery and are conversant with the spinal anatomy and anaesthesiologists well-versed in the procedure, should be the operators to perform the epidural injections.

ACKNOWLEDGEMENTS

The author is indebted to Professor John CY Leong for his valuable advice, Dr Christopher CH Tse for the computer analysis of the data, and Dr Clement TH Loy for reference research.

REFERENCES


29. Kelvin WT (1824–1907) British mathematician and physicist, introduced the Kelvin scale, or absolute scale, of temperature.


