Acta orthop. scand. 48, 635–641, 1977

DOUBLE BLIND EVALUATION OF EXTRADURAL METHYL PREDNISOLONE FOR HERNIATED LUMBAR DISCS

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A double blind study was carried out in 51 patients suffering from lumbar root compression syndrome of 12 days to 36 weeks duration. All patients had signs, symptoms and radiological abnormalities related to a herniated lumbar disc. Each patient received an extradural injection of either 2 ml (80 mg) methyl prednisolone or 2 ml normal saline solution. Neurological examination and interview of the patients with the aid of a questionnaire before and after extradural injection failed to demonstrate any statistically significant difference in outcome between the two groups. At follow-up 14 ± 6 months after extradural injection 58.3 per cent of the patients in the control group and 51.9 per cent of the patients in the treatment group had undergone surgical treatment with laminectomy. Our results indicate that a single extradural injection of methyl prednisolone (80 mg) is no more effective than a placebo injection in relieving chronic symptoms due to myelographically demonstrable lumbar disc herniation.

Key words: sciatica; intervertebral disc displacement; extradural injections; methyl prednisolone

Accepted 24.vi.77

For more than 20 years water-soluble corticosteroid drugs have been used in the treatment of sciatica. Various administrative techniques have been employed. Extradural injection at the affected lumbar level (Barry & Hume Kendall 1962), or at the sacro-coccygeal level via the sacral hiatus (Lindblom & Salenius 1964) and via dorsal sacral foramina (Renier 1959), local intrathecal injection (Sehgal & Gardner 1960) and systemic application by the intramuscular route (Green 1975), have all been advocated. Corticosteroid infiltration of the extradural space at the affected spinal level now appears to be the most popular technique. If effective it constitutes a major advance in the non-operative management of the lumbar root compression syndrome. It is rapid, can be performed on an out-patient basis and appears to be safe (Jurmand 1973), although warnings have been given about the dangers of intraspinal injections without proper diagnosis (Shealy 1966). Many papers appear to prove the effectiveness of extradural steroid injections, but there is a scarcity of controlled studies which take account of the variable and episodic nature of the pain characterizing the natural history of the lumbar root compression syndrome

Table 1. Comparability of groups before injection. Clinical data of 51 patients with herniated lumbar disc.

	Placebo	Methyl prednisolone
Total treated	24	27
Average age in years (range)	46.5 (27–67)	43.8 (26–59)
Sex:		
Males	13	13
Females	11	14
Duration of main complaint (present attack):		
Average	10.8 weeks	11.5 weeks
Range	17 days–36 weeks	12 days–36 weeks
Vertebral levels of disc herniation:		
L_3–L_4	2	
L_4–L_5	11	15
L_5–S_1	11	12
Neurological deficit:	24	27
Sciatic scoliosis and/or lumbar deviation	15	16
Positive Lasègue's sign	20	22
Abnormal ankle jerk	15	12
Non-progressive lower extremity weakness	9	8
Radicular sensory deficit	10	10
Pain:	24	27
Low back pain	8	9
Radiating pain	24	27
Impulse pain	14	20
Pain interfering with sleep	13	13
Necessity for analgesics	19	20
Records obtained from physiotherapist	14	20

(Pearce & Moll 1967). The aim of the present study therefore is to evaluate objectively methyl prednisolone, 80 mg, applied extradurally at the fourth lumbar, fifth lumbar or first sacral nerve root level in the treatment of the lumbar root compression syndrome.

MATERIAL

The patients included in this study were selected from a consecutive series of more than 200 patients admitted to the Department of Neurology, Ullevål Hospital, between May 1974 and April 1975, for treatment of unilateral sciatica.

The criteria for admission to this trial were the presence of (1) radiating pain in the distribution of the sciatic or femoral nerves, (2) a neurological deficit that correlated with a compression of the fourth or fifth lumbar or first sacral nerve root and (3) myelographic findings at the appropriate level and side. Lumbar myelography was performed with metrizamide (Amipaque®). Radiologically diagnostic features were indentation of the dural sac, and/or increased width of the root and shortening of the root sleeve.

Grounds for exclusion were acute severe motor paresis, evidence of compression of the cauda equina, intolerable pain, previous surgery to the lumbar spine, coincident medical conditions known to be contraindications to corticosteroid therapy and any doubt about the myelography findings.

51 patients satisfied the criteria and consented to participate in the trial.

METHODS

The selected patients were randomly divided into two comparable groups (Table 1) by one of the authors (B.J.). The control group received a lumbar extradural injection of 2 ml of normal

saline, and the treated group received an injection of 80 mg (2 ml) methyl prednisolone acetate (Depo Medrol®). All injections were performed by B.J. using the direct approach through the interspinous ligament at the level of the disc lesion as described by Barry & Hume Kendall (1962). The patients were placed on the affected side with hips and spine fully flexed. The extradural space was identified by the "loss of resistance test" of Dogliotti (1933), and after the injection the patients were left on the same side for a few minutes to allow accumulation of the steroid at the required level and side.

All patients were restricted to bed for the first 7 days of hospitalization, but from the eighth day were allowed to walk about freely. Physiotherapy, mainly consisting of instruction and isometric training of the appropriate muscle groups, was identical for all. The duration of stay at the department of neurology was 14 ± 4 days. Those patients who did not improve sufficiently were then transferred to the physiotherapy department or to the neurosurgery department if a complete evaluation indicated the need for laminectomy.

All patients were examined by the same neurologist (W.S.) 12 ± 10 hours before and 48 ± 24 hours after the injection. Neither patient nor examiner knew to which group the patient belonged. The following variable factors were recorded:

1) *Mobility and deformity of the lumbar spine*

The spinal process of L_1 and S_1 were marked on the skin. The patient stood with his back to the examiner with equal weight on both feet and a plumb line was suspended in such a manner that it covered the spinal process of S_1 at all times during the examination. Any sciatic scoliosis or lumbar deviation was recorded and if it disappeared after injection, this was categorized as improvement. The patient was then asked to bend maximally to the right and to the left, and the distance between the plumb line and the spinal process of L_1 was recorded (Figure 1). Thus a reproducible expression of the mobility in the frontal plane was obtained. The examiner constantly checked with his hands that the hip area did not move. The mobility in the sagittal plane was recorded as the difference in the distance between S_1 and L_1 in the neutral position and maximal forward and backward flexion, respectively. An increase in mobility of 2 cm or more in either plane after injection was categorized as improvement.

2) *Lasègue's test*

This was performed with the patient lying on his back. Keeping the knee straight, the leg was slowly raised until the patient experienced radiating pain in the distribution of the sciatic nerve. A "positive Lasègue sign" was recorded when the test provoked radiating pain before 50° elevation was accomplished. The recording of the angle of elevation was made with a goniometer. If after injection the angle had improved by 20° or more this was recorded as increased sciatic nerve stretch tolerance.

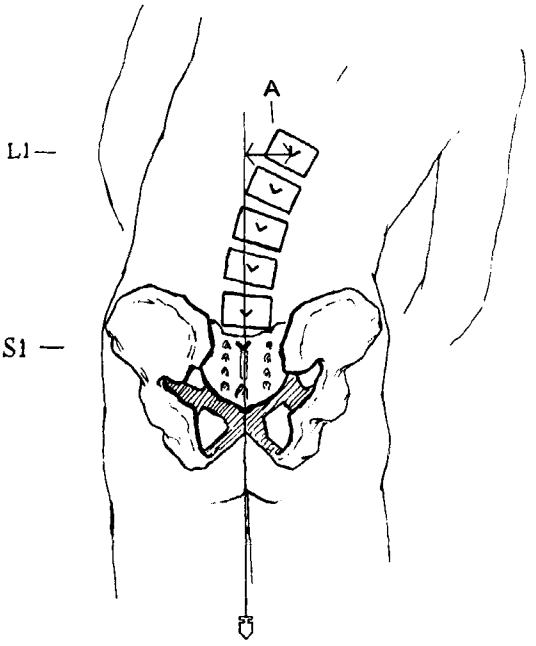

Figure 1. Measurement of mobility in the frontal plane of the lumbar spine. The patient performs a maximal lateral flexion to both sides. The distance A between the plumb line through S_1 and the spinous process L_1 is measured in cm (From Weber 1973).

3) *Neurological deficit*

a) *Ankle jerk.* This reflex was examined while the patient supported himself on his hands and knees. Evaluation of the strength of the reflex contraction was made during the sixth and seventh strikes against the Achilles tendon. Deflection of the movement of the foot on the unaffected leg was used as a control.

b) *Motor function.* This was examined in all patients by the conventional manual technique. The strength of the muscles with the following functions was measured during maximum isometric contraction: dorsal extension of the big toe, the four lateral toes and the entire foot, eversion of the foot, abduction and extension of the leg, and flexion of the foot and the knee.

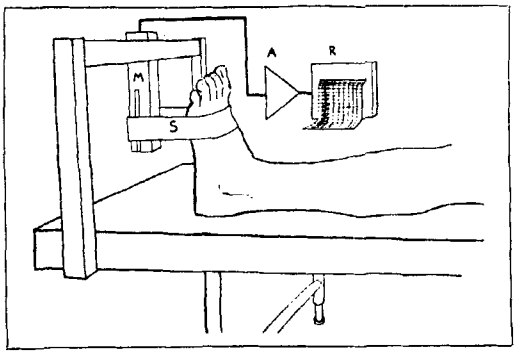

Figure 2. Measurement of strength in the muscle groups which cause dorsal flexion of the foot (from Weber 1975).

The maximum muscle strength here is defined as the maximum force which the muscle can develop and maintain for a brief period of time (1–2 seconds). In 17 patients with a detectable paresis, the isometric strength in the affected muscle groups was recorded mechanically as shown in Figure 2. The patient lay on a bench. With the aid of a non-stretchable strap, the foot was fixed to a measurement beam with built-in strain gauges. The electrical signals were transferred to a direct recorder which showed the deflections on squared paper. The mean value of two readings was recorded, but if the difference between these exceeded 5 per cent of the deflection a third measurement was made. In this way one always obtained two recordings which satisfied the requirements. Corresponding muscle groups were examined alternately in the affected and the unaffected leg with exactly the same starting position and necessary support. The difference in the measured strength in the two legs provided an expression of the degree of the paresis and corresponded well with the clinical evaluation.

c) *Sensory function.* The patients' reaction to pin-pricking was examined in both legs. In 20 instances a radicular sensory deficit was detected and the localization and extent of this were recorded on a sensibility scheme.

4) *Pain*

For the patient with sciatica, pain is the dominating and most disabling symptom. With the aid of a questionnaire the subjective pain was recorded before and after injection. The following types of pain were defined and assessed:

a) low back pain, which was a prominent feature in only 17 of the patients. If it disappeared after injection, this was recorded as improvement.

b) radiating pain in the distribution of either the sciatic or femoral nerve was present in all patients. If it disappeared or did not extend as far after injection, this was recorded as improvement.

c) impulse pain, i.e., provocation or worsening of radiating pain by coughing or sneezing, is thought to be a sign of spinal nerve root irritation, and was present in 34 patients of our series. If this sign disappeared after injection, this was recorded as improvement.

d) pain interfering with sleep, wakening the patient at night or completely inhibiting normal sleep was reported in 26 cases. Improvement was recorded if after injection the subjects no longer awakened because of pain.

5) *Analgesic consumption*

The patients were given an analgesic tablet on request only. Two different compounds were used, but each patient only received one of these. If after injection the patient no longer requested any analgesic, this was recorded as an improvement.

6) *Statement by the physiotherapist*

The patient's physiotherapist recorded his impression of the condition of the patient on the basis of clinical judgement of the patient's ability to perform physical activities before and after injection. The physiotherapist did not know which type of injection had been given. Records were only available for 35 of the patients.

7) *The patient's own assessment*

At the second examination the patient was asked if he subjectively felt an improvement, had experienced no change or had deteriorated after the extradural injection.

RESULTS

Early results

Table 2 presents the results, indicating a general improvement in both the treated and the control group. The difference in results between the two groups is statistically not significant.

Follow-up study

All patients included in this study were reviewed in December 1975. The follow-up period ranged from 8 months for

Table 2. Early results.

	Placebo (%) *	Methyl prednisolone (%) *	P **
Improvement of sciatic scoliosis and/or lumbar deviation	33.3	12.5	0.34
Increased mobility in lumbar spine			
Sagittal plane	8.3	25.9	0.20
Frontal plane	50.0	44.4	0.92
Increased sciatic nerve stretch tolerance	25.0	36.4	0.65
Improvement of abnormal ankle jerk	0.0	0.0	
Improvement of lower extremity weakness	0.0	25.0	0.40
Improvement of radicular sensory deficit	0.0	0.0	
Relief of low back pain	25.0	33.3	0.88
Relief of radiating pain	12.5	25.9	0.37
Relief of impulse pain	7.1	25.0	0.38
Relief of pain interfering with sleep	23.1	53.8	0.24
Discontinuance of analgesic consumption	15.8	40.0	0.19
Improvement stated by physiotherapist	42.8	70.0	0.22
Improvement felt subjectively by the patient	41.7	66.7	0.13

* Refers to the number of affected patients who improved, not the degree of improvement. Compare with basic data in Table 1.

** Differences between groups have been tested by ordinary chi-square statistical methods with one degree of freedom and with Yates correction, regarding *P*-values less than 0.05 as significant.

those admitted in April 1975 to nearly 20 months for those admitted in May 1974. The patient records were reviewed to ascertain whether laminectomy had been necessary since injection. Where this information could not be obtained from the record, the patient was contacted by letter or telephone. Review of the operation records from the department of neurosurgery showed that in all the cases operated upon, i.e., 14 patients in each group, a disc prolapse was found at the level and side indicated by myelography.

Complications

Apart from a few patients who felt increased pain of sciatic distribution shortly after the extradural injection, there were no complications or side effects attributable to the injection.

DISCUSSION

In our study there was no statistically significant difference in the outcome between the treated and the control group. It follows that a single dose of methyl prednisolone, 80 mg, injected extradurally was no more effective than the placebo in relieving chronic symptoms due to lumbar disc herniation demonstrable by myelography.

Our conclusion is derived from a small number of patients and contradicts the wider based experience of many different researchers. However, of the previous trials only Dilke et al. (1973) have reported a carefully controlled double blind study of extradural steroid medication. In a series of 100 consecutive patients with a clinical diagnosis of lumbar root compression by a herniated lumbar disc they observed significant alleviation of the symptoms after injection of methyl prednisolone, 80 mg. The apparent disparity in results between their study and

our own may be related to a difference in selection of material since Dilke et al. did not consider myelography findings as a criterion, whereas all the patients in our study had a demonstrable disc herniation. Harley (1967) demonstrated that most of the patients who benefit from extradural steroid infiltration have no myelographic abnormality, and Colonna & Friedenberg (1949) showed that the prognosis of non-operative treatment is poorer when the extruded mass of the disc reaches a stage where it can be visualized by myelography.

Our results reflect the findings at 48 ± 24 hours after treatment. Burn & Langdon (1974) found a temporary relief of symptoms in 37 per cent of their patients treated with extradural steroid injection and manipulation under anaesthesia. The period of relief of symptoms varied from only a few days to several months. It may be therefore that further follow-up of our own patients would have yielded even poorer results.

Our placebo injection appeared to be strikingly effective. It is unreasonable, however, to suspect any therapeutic action from extradural injection of 2 ml normal saline. Certainly Evans (1930) found that extradural injection of 30 ml of normal saline relieves sciatic pain, but this is fifteen times the amount used in our study. More likely the general improvement of our patients in both groups is at least in part due to the strict bed rest which was instituted directly after admission.

In this study myelography was performed with metrizamide (Amipaque®), a water-soluble contrast which has been shown to have markedly reduced irritative effects compared with other water-soluble contrast media (Skalpe et al. 1973). The use of metrizamide is therefore unlikely to have had any direct effect in itself on the patients' symptoms or signs.

In assessing the significance of our results, it should also be taken into account that only a single dose of methyl prednisolone, 80 mg, was given and only patients with long-standing symptoms of lumbar root compression, nearly 3 months' duration on average, were included in our study. According to Solheim (1960) and Jurmand (1973) acute cases of sciatica respond better to extradural steroid infiltration than do the subacute and chronic cases. Dilke et al. (1973) claim that a second injection of methyl prednisolone given a few days after the first may be successful when there has been incomplete or even no response to the first, whereas a third injection is rarely helpful. Burn & Langdon (1974) showed that the duration of action of methyl prednisolone when injected into the extradural space was about 2 weeks. Hence another injection after a few days means accumulation of the active substance. We found it difficult, however, to investigate with double blind methods the possible effect of repeated injections. Further investigations are required to assess objectively the value of higher steroid dosage and the effectiveness of extradural steroid medication in acute cases of sciatica with and without myelography findings.

ACKNOWLEDGEMENTS

The authors of this study are indebted to Dr. I. Holme of the Life Insurance Companies' Institute for Medical Statistics, Ullevål Hospital, for carrying out the calculations of the statistical significance of our data. We wish also to acknowledge our debt to Dr. P. P. Lowe of the Department of Radiology, Ullevål Hospital, for helpful advice and revision of the translation.

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