FACET JOINT INJECTION FOR LOW BACK PAIN
A CLINICAL STUDY

M. C. LYNCH, J. F. TAYLOR

From Broadgreen Hospital and Royal Liverpool Hospital, Liverpool

Therapeutic injection of facet joints is now widely practised, but British experience has been infrequently reported. We studied the results of injecting facet joints with a corticosteroid preparation in 50 patients suffering from the "facet syndrome". Our series included a number of extra-articular injections and these "failed injections" provide a useful control group. Results indicate that only intra-articular injections are effective; certainty of joint penetration can be ensured only by the routine use of joint arthrography.

Successful treatment of the various causes of low back pain demands accurate diagnosis; the main difficulty is to match the clinical history and physical signs with a particular pathological process. Intervertebral disc prolapse, described by Mixter and Barr (1934), has been found to be associated with characteristic signs in the lower limb which permit accurate diagnosis and, if necessary, effective treatment by surgery or chemonucleolysis. However, the principal source of pain may be difficult to determine in a middle-aged patient with chronic low back pain not radiating below the knee and with no radiological signs of lumbar spondylosis. A number of authors contend that the posterior spinal joints are largely responsible for the symptoms in this type of patient (Goldthwait 1911; Ghormley 1933; Badgley 1941; Sinclair et al. 1948; Lewin, Moffett and Viidik 1962; Hockaday and Whitty 1967; Mooney and Robertson 1976).

The facet joints, although small, share the morphological features of larger synovial joints elsewhere in the body, many of which are commonly affected by painful osteoarthritis. Unlike these larger joints, the facet joints do not exhibit noticeable radiographic changes with early degeneration. Putti (1927) and Putti and Logròscino (1938) found evidence of lumbosacral osteoarthrosis in all of a series of 75 cadaveric specimens aged 40 years or more. This observation suggests that there is no direct correlation between radiographic findings and symptoms; this concept has been supported by Carrera et al. (1980) who found, in a series of 100 patients, that CT scans revealed arthropathy in many patients with normal plain lumbar radiographs.

The facet joints, in common with other posterior spinal structures, receive sensory innervation from the posterior primary rami. Numerous studies have been reported in which volunteers were given pain-provoking injections into the posterior structures in order to simulate disease processes (Kellgren 1938, 1939; Sinclair et al. 1948; Lewin et al. 1962; Hirsch, Ingelmark and Miller 1963). In most cases, hypertonic saline was used, and the induced areas of local and referred pain were recorded.

Hirsch et al. (1963) were the first to claim successful injection of facet joints, although arthrography was not used to confirm entry into the joint. Following the injection of hypertonic saline, volunteers reported severe local back pain with variable radiation to the ipsilateral buttock or posterior thigh, but never below the knee. A comparable study carried out by McCall, Park and O'Brien (1979) used arthrography to ensure intra-articular placement of the needle. Similar patterns of pain radiation were reported, and again no subject experienced pain below the knee.

Mooney and Robertson (1976) showed that some signs usually associated with prolapsed intervertebral disc, and therefore with anterior ramus compression, could be caused by pathological change in facet joints. A series of volunteer patients with back pain were given saline injections into facet joints. Some of them developed diminution of straight-leg raising and even absence of ankle jerks during the experiment. Mooney and Robertson proved that these effects were due to painful stimuli arising in the capsules of the facet joints and mediated by the posterior primary rami. According to this work the only reliable neurological signs of anterior ramus dysfunction are therefore specific sensory or motor loss.

The poor localisation of facet joint pain is explained by the pattern of sensory innervation of these joints. Each joint has a "two level" sensory supply: by a branch of the medial division of the posterior primary ramus at its own level, and by a descending branch of the medial division from the level above. This observation has been made by Stilwell (1956) and by Lewin et al. (1962), but does not appear in standard anatomical texts.
Facet joint injection was used by Carrera (1980a,b) for both diagnosis and treatment of facet disease. Of his 20 subjects, 30% obtained long-term relief of back pain following the instillation of corticosteroid and local anaesthetic. Destouet et al. (1982) reported long-term relief of pain in 20% of 54 patients. Basing their selection on the experimental findings given above, Mooney and Robertson (1976) injected multiple facet joints in each of 100 patients diagnosed as suffering from "facet syndrome". They recorded a 20% long-term relief from pain but, unfortunately, did not employ arthography routinely and it is not possible to know the percentage of injections which were actually intra-articular.

PATIENTS AND METHODS
A prospective study was made of 50 patients diagnosed as having chronic back pain arising from lumbar facet joints. Patients suffering low back pain for more than six months with focal paraspinal tenderness and worsening of pain on hyperextension were eligible for admission to the study. All the patients had been previously treated by analgesics, physiotherapy or a support. Patients with true motor weakness or anaesthesia were excluded as were those with systemic arthropathy or radiological evidence of disorders other than the "facet syndrome". The radiological criteria for exclusion included bone disease, spondylolisthesis and spondylothesis.

At the first consultation a full history and clinical examination were supplemented by anteroposterior, lateral and oblique radiographs of the lumbosacral spine, which were reported independently by three consultant radiologists. Twenty-six sets of radiographs were reported to show no abnormality, one showed a fixed lumbar scoliosis and one revealed old Scheuermann's disease. The remaining sets of radiographs were all reported as showing either generalised osteoarthrits of the lumbar spine or localised degeneration of facet joints associated with long-standing narrowing of a disc space.

Patients were reviewed two weeks, three months and then six months after their injections. No review radiographs were taken. The authors themselves reviewed the patients only once, the other two reviews being carried out by medical staff with no prior knowledge of the aims of the investigation. The clinical findings were recorded on a special proforma.

Site and method of injection. An injection was placed in the disordered joint, as determined by clinical and radiological examination. In most cases this was the L5-S1 joint. The joint above was also routinely injected to allow for errors in diagnosis due to the overlapping sensory supply.

The patient lay prone on a moveable radiographic screening table which was tilted until the joint space at the level to be injected was clearly seen in an oblique view of the lumbar spine. To assist penetration of the posterior part of the joint, the angle of tilt was then reduced by about 15°. For the lumbosacral articulation, this usually gave an inclination of about 30° between the patient's pelvis and the table. A skin marker was placed so as to overlie the affected joint on screening, and the skin was anaesthetised with 0.5% lignocaine. An 18-gauge disposable spinal needle was then advanced vertically down to bone, and manipulated until the tip appeared to be adjacent to the joint interval. An arthrogram was then attempted by the injection of 0.5 ml iopamidol (Niopam 400) (Fig. 1). If the contrast medium did not enter the joint, it diffused through the tissues and made further attempts at intra-articular placement impossible. Whether or not the joint had been entered, 60 mg of methylprednisolone was then injected. There were three possible permutations of placement of the injections in the two joints for each patient. Either injections at both levels were intra-articular, or one was intra-articular and one extra-articular, or both injections failed to enter the joint.

RESULTS
There were 38 women and 12 men in the series. Their ages ranged from 20 to 76 years (mean 44.7 years, sd 13.7 years). At the time of injection, depending upon the arthograms, each patient was designated as having had two, one or no injections actually into joints, as defined above. To assess the therapeutic efficacy of the treatment, subjective relief of pain was noted at each review and recorded as total relief, partial relief or no relief.

Two weeks after injection 11 patients reported total relief of pain, 28 had partial relief and 11 no relief (Table I). After three months, three partially relieved patients had total relief, but eight had deteriorated into the "no
Table I. Pain relief related to time since injection in 50 patients

<table>
<thead>
<tr>
<th>Time since injection</th>
<th>Pain relief</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>2 weeks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td>3 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td>6 months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

Table II. Relief of pain at two weeks related to the intra- or extra-articular site of the two injections

<table>
<thead>
<tr>
<th>Site of injections</th>
<th>Pain relief</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Both intra-articular</td>
<td>9</td>
</tr>
<tr>
<td>One intra-articular</td>
<td>2</td>
</tr>
<tr>
<td>Neither intra-articular</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
</tr>
</tbody>
</table>

relief group; after six months, a further three patients with partial relief had deteriorated. Thus only those patients who reported partial relief of pain at the initial review experienced a later change in pain level; patients with early total relief retained this and patients with no early relief did not improve. Six months after injection, 14 patients (28%) enjoyed total relief of symptoms and a further 14 patients (28%) had partial relief.

The assessment after two weeks was chosen arbitrarily in an attempt to correlate the pain relief with the site of the injection in relation to the joint (Table II). Of the 11 patients gaining total relief, nine had two intra-articular injections, two had had injections into one joint and no patient had relief from two failed injections. In the partially relieved group, 16 patients had two intra-articular injections, 4 had one failed injection and 8 had two failed injections. Of the patients who had no pain relief, 2 had two intra-articular injections, 2 had one and 7 had two failed injections. Application of the chi-square test showed a highly significant correlation between total pain relief and the site of injection. Injection into both joints was more effective than into one joint ($\chi^2 = 17.0, P < 0.001$). Injection into only one joint was more effective than two failed injections ($\chi^2 = 20.0, P < 0.001$).

Of the 27 patients who received intra-articular injection at both vertebral levels, 26 reported the provocation of deep-seated low back pain as the steroid suspension was injected under some pressure. In 13 of these patients, there was some radiation of pain to the ipsilateral buttock and upper thigh, but in no case was there pain below the knee.

**DISCUSSION**

The overlapping nerve supply of the facet joints has significance for the placement of therapeutic injections. If the affected joint could be identified with certainty, then only that joint would need to be injected, but it is our experience that, within the limits imposed by current commonly performed methods of investigation, such certainty is not usually possible. The routine injection of two joints, as in this series, is therefore recommended.

The posterior and anterior primary rami of a nerve root diverge at the intervertebral foramen. The posterior ramus runs over the adjacent transverse process (Fig. 2) and at this point divides into medial, lateral and intermediate branches. The medial branch supplies the facet joint at its own level, and also supplies the joint below. There has been some controversy about this double sensory innervation of the facet joints. Bogduk, Wilson and Tynan (1982) observed the dual branching pattern and were unable to demonstrate triple overlapping, or any more complex organisation. In our own dissections of human cadaveric specimens (Figs 3 and 4), we have also been unable to demonstrate any arrangement which differs significantly from that described by Stilwell (1956) and Lewin et al. (1962).

The constancy with which the medial branch passes between the mammillary and accessory processes of the transverse process is of relevance to other therapeutic measures. This branch may be semi-permanently blocked using a cryoprobe, or permanently interrupted using radiofrequency coagulation. In both methods, probes can be advanced accurately to the precise anatomical site with the use of fluoroscopic guidance alone.

In the present study, chronic facet joint disorders were found to be three times more common in women,
which may be related to the rigours of caring for home and family. However, we believe that the principal cause of the increased incidence of symptomatic facet joint disorders in women is related to their greater lumbar lordosis. This means that each synovial joint is more extended than in the male, and it has been reported that each degree of increased extension leads to a 4% increase in peak articular pressure (Dunlop, Adams and Hutton 1984).

Whatever the precise pathology of degeneration in facet joints, it is likely that inflammation of the synovium produces the pain. Sinclair et al. (1948) have described the histology of the rich sensory supply to the facet joint lining. This source for the pain is supported by the relatively high response to intra-articular steroid injection. If the response to this treatment resulted from "acupuncture" or psychological effects, we would not have expected the highly significant difference between the results of intra- and extra-articular injection. At no stage were the patients aware of the exact site of their injections.

The good response rate to intra-articular injection also supports Mooney and Robertson's concept of a facet syndrome. The patients studied in our series were selected on the basis of symptoms and signs similar to those described by these authors. The fact that 56% of the patients had partial or complete relief of pain six months after injection leads us to conclude that a synovial joint disorder is largely responsible for the syndrome. The success rate achieved, 14 patients (28%) with total relief of pain at six months, accords well with previous reports of 19% to 30% relief (Mooney and Robertson 1976; Carrera 1980b; Destouet et al. 1982).

This series has been the first to compare the efficacy of intra- and extra-articular injections. The results demonstrate that injections into the joints are far more effective for long-term pain relief than are extra-articular injections.

The authors are grateful to Dr D. Troup of the Department of Orthopedic and Accident Surgery, University of Liverpool, for his help and suggestions during the preparation of this paper.

REFERENCES

Gormanley RK. Low back pain with special reference to the articular facets, with presentation of an operative procedure. JAMA 1933;101:1773-7.
Putti V. New conceptions in the pathogenesis of sciatic pain. Lancet 1927;i:53-60.