Percutaneous radiofrequency denervation of spinal facets

Treatment for chronic back pain and sciatica

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A technique for radiofrequency localization and coagulation of articular nerves supplying the spinal facets is described and results are reported from a series of 207 patients followed 6 to 21 months (mean 13 months). Relief of pain was achieved in 79% of previously unoperated patients, in 41% of those with laminectomy but no fusion, and in 27% of those with an earlier fusion. No neurological complications were encountered.

KEY WORDS • facet nerve • disc syndrome • sciatica • back pain

In 1911, Goldthwait reported sciatica resulting from abnormalities of the lumbosacral articulations. Putti, in 1927, stated “sciatica is a neuralgia caused by pathological conditions of the intervertebral foramina and especially of the intervertebral articulations.” Pedersen, et al., reported innervation of the inferior facet by five branches of the postroot passing through the intervertebral ligament and then caudally to enter the lateral portion of the facet. Fox and Rizzoli have recently confirmed this anatomical work.

In 1971, Rees reported over 2000 operations by a closed surgical procedure in which a long scalpel blade penetrated to the intertransverse ligament to sever the postrami supplying facet articular capsules. We performed this procedure according to Rees’ technique in 29 patients, and were impressed with its potential for relief of back and sciatic pain. However, a huge hematoma was produced in six of our patients, which has led us to develop a less traumatic radiofrequency technique. A preliminary report of our results was presented in 1973.

Method and Clinical Material

Technique

Following localization of puncture points under fluoroscopy directly over the facet joints in question, 1% Xylocaine local anesthesia is placed intradermally in the site above each facet and slightly lateral to it. A No. 12 gauge thin-walled needle is introduced directly through skin and muscle to touch the center of the facet as identified fluoroscopically. Similar needles are inserted to touch each joint that is to be tested.

A thermistor electrode (19 cm in length and 1.2 mm in diameter) is introduced through one of the guide needles, deflected laterally to the side of the facet near its longitudinal center, and is advanced to the level of the intertransverse ligament which is identified not
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only by a tactile sensation of increased resistance but also by anteroposterior and lateral Polaroid radiographs confirming correct placement of the needle after fluoroscopic guidance to the desired position. Electrical direct current continuous pulses of 1 msec duration and 25 cps are then employed to determine possible proximity of the thermistor electrode tip to the spinal nerve root. When the appropriate area is reached, lateral to but immediately adjacent to the facet, stimulation at 1 to 2 V characteristically produces tingling or an unpleasant deep aching sensation; severe, sharp pain is elicited at 2 to 4 V. If the electrode is too close to the spinal root, severe radicular pain in a characteristic dermatome distribution occurs with less than 1 V and dermatomal contractions occur between 1 and 2 V.

The distribution of the pain experienced by patients during electrical stimulation is frequently interpreted as being very similar to that of their original pain. Often pain radiates into the buttock and sciatic distributions, but rarely distal to the knee. Diffuse radiation into the foot is unusual. Infrequently there are referral components of the pain to the contralateral area of the back and buttock, except in patients with previous fusions, where such contralateral referred pain occurs over 10% of the time. Anterior thigh pain may be evoked by stimulation at L1-2, L2-3, or L3-4; however, each of these areas has also, on occasion, reproduced clear-cut sciatic pain. When pain relief is not obtained at the lower lumbar levels, it seems advisable at least to stimulate upper lumbar facet nerves to try to evoke the clinical area of pain.

Following final radiographic and electrical confirmation of desired electrode position, the radiofrequency (RF) generator is activated. The lesion temperature as monitored by a thermistor probe is gradually raised over a 1 to 2-minute period to 80°C with maintenance of this temperature for 150 seconds. At present we recommend a 50-second lesion with the electrode tip at the center of the joint and 50 seconds each with a sweeping movement of the electrode hub both superiorly and caudally to cover the entire lateral margin of the facet.

The procedure is repeated at other involved levels. The patient is returned directly to his room, where, after 2 hours of bed rest, he is encouraged to become active and engage in flexion-extension type of spinal exercises. Patients may be discharged on the following hospital day if they are free of pain, at which time a good indication of procedure result is evident. Indeed, pain relief is usually obvious at completion of the RF lesions.

Selection of Patients

Although we have carried out the procedure in 300 patients, only 207 patients have a follow-up of at least 6 months. In the 207 patients to be reported, follow-up ranged from 6 to 21 months with a mean of 13 months.

We have divided our patients into the following categories:

Group 1. Previously Unoperated Patients. The 57 patients in this group had a minimum duration of pain of 3 months (average over 2 years). Of these, 22 had had recent myelograms; in three, filling defects covering one-half the width of the spinal canal were seen but no nerve root deficit was present. Ten patients had small myelographic defects of questionable significance. Six of the patients had vertebral compression fractures and facet denervation was limited to joints adjacent to the compression.

Group 2. Previously Operated Patients Without Fusion. The 60 patients in this group had undergone an average of three partial or total hemilaminectomies. A diagnosis of arachnoiditis had been made in 10 of these patients. Two patients had had a lumbar rhizotomy of one root and two a cordotomy.

Group 3. Patients With Spinal Fusion. The 90 patients in this group had undergone an average of four previous spinal surgical procedures. Three patients had had a spinal rhizotomy, two a cingulectomy, one a thalamotomy, and nine one or more cordotomies. Twenty-five patients had had a diagnosis of arachnoiditis.

In 10 other patients the facet nerves had been surgically identified at open surgery. In one of the previously unoperated patients considered a failure, only 50% pain relief was obtained by the RF lesion; discography confirmed the clinically-suspected ruptured disc at L5–S1. At surgery, necrosis was observed in the area where the articular nerves are usually found.
Results

Results were determined by direct telephone questioning of each patient by a research assistant. Patients were asked the five questions recently suggested by Picaza, et al., 8 to be the standard for pain profile:

1. How much of the time do you have pain? (0-100%)
2. How severe is your pain? (mild, discomforting, distressing, horrible)
3. How much does pain inhibit your physical activity? (0-100%)
4. What drugs and amounts are you taking?
5. How does the pain affect your personality?

All answers were graded 0 to 4 (maximum abnormality). Before treatment the average patient profile was 43343 (an average of 17 points if the five categories are added). We have arbitrarily classified results as follows:

1. Excellent. A maximum of 6 points total (12111), with pain present not more than 25% of time; our average patient classified as excellent had less than 6 points.
2. Good. A maximum of 8 points total (2221 I); our average patient classified as good had less than 8 points.
3. Failed. All other patients were classified as failures.

Our results are summarized in Table 1.

No neurological complications were seen in this series. Four patients of the total of 300 developed superficial burns from unrecognized insulation breaks, but none of these was significant.

Discussion

The classic syndrome of disc herniation with impaired straight leg raising, motor weakness, deep tendon reflex changes and/or sensory impairment, low back pain, sciatica, and positive myelographic findings has been successfully treated for 30 years with partial hemilaminectomy, removal of ruptured disc fragment, and nerve root decompression when conservative measures fail. 9 This group, however, represents only a small proportion of all patients complaining of chronic low back pain and sciatica. Attempts to relieve chronic symptoms by hemilaminectomy and disc removal may worsen or fail to resolve the patient's original symptoms in the following syndromes:

1. Chronic low back pain with or without sciatica, and little or no motor, reflex, or sensory changes. Such patients often have a virtually normal myelogram or a minimal abnormality of questionable significance.
2. Lumbar spondylosis with long-standing degenerative disc disease.
3. Pure "discogentic" pain, as reported by Cloward. 1
4. Disc surgery failures who have undergone previous laminectomies with or without fusion.

In the patients reported here, a majority represented failures of earlier lumbar surgery and most had been diagnosed as having a ruptured disc. Review of original operative notes in the 250 patients previously operated elsewhere, however, revealed definitive reports of disc herniation in only six of these patients. In 20 others the information supplied was insufficient to make a diagnosis; and in 224 patients the operative note clearly indicated that the original pathology consisted of a bulging, degenerated disc. It is therefore easy to understand the failure of pain relief with disc removal in these patients. Pertinent to this fact is our finding of only one ruptured disc in 45 of our Group 1 patients previously unoperated but otherwise complaining of back and sciatic pain similar in
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nature to that of the patients who had failed to benefit from earlier hemilaminectomy, disc removal, and/or fusion.

Late results of facet denervation are not quite as good as those seen with follow-ups of 1 to 6 months as reported by Shealy, et al.,9 where the lumbar procedure achieved excellent or good results in 88% of previously unoperated patients, in 67% of operated patients, and in 33% of patients with fusion.

In most of our late failures the return of pain occurred within less than 1 month after the procedure. Only four failures were first seen more than a month later; in three of these the procedure was repeated, with total relief of pain in two and marked improvement in the third.

The obvious question in all patients is why the articular nerve does not regenerate, since it is postganglionic. This question must remain unanswered, but the results obtained in unoperated patients were quite encouraging. And even in our most difficult patients, those with a fusion, valuable improvement was obtained in 26 patients with a simple, safe procedure, when there was no comparable alternative therapy. The high rate of failures in the group with operation and fusion must be related to the extensive scarring, often coupled with arachnoiditis, seen after so much surgery.

One of the essential aspects of management of the really chronic patients who have had difficulty for over 1 year is an aggressive operant conditioning program supplemented with exercise, external electrical stimulation, and autogenic training. Only if patients are taught how to rehabilitate themselves will the facet denervation play an important role in the overall management of these most chronic cases.

The number of cases with procedures in the cervical and thoracic regions is too small to allow analysis. Furthermore, the procedure in those regions is more difficult because of the proximity of the main nerve root.

The technique of facet denervation is simple and safe. Its ultimate place in our therapeutic armamentarium awaits considerable further time and experience.

References


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