

the fact that cigarette smoking is an important risk factor for many more conditions than just cancer of the lung. The incidence of bladder cancer, laryngeal cancer and possibly oral and esophageal cancer is increased in heavy smokers of cigarettes. Furthermore, the toll of smoking-induced respiratory disease and coronary heart disease is well known. It is possible that persons at risk of dying from these conditions if they smoke heavily are not the same as those at risk of dying from lung cancer.¹¹ Thus, increased efforts at prevention of cigarette smoking in the young and reduction of cigarette smoking in adults must be pursued.

Canada is not alone in showing substantial increases for women in mortality rates for what is undoubtedly

smoking-induced lung cancer over a decade in which knowledge of the association has been most prevalent. Similar findings have recently been reported from Denmark.¹²

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Percutaneous radiofrequency lumbar rhizolysis (rhizotomy)

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Low back pain may arise from degenerative changes in the posterior joints of the lumbar spine. These joints are innervated by a branch of the posterior primary ramus, which follows an anatomically constant course. Pain impulses from these joints can be interrupted by coagulating this nerve with a radiofrequency wave, the probe having been placed in the area of the nerve percutaneously.

Percutaneous lumbar rhizolysis was carried out under local anesthesia on an outpatient basis in 82 patients, most of whom had multiple level rhizolysis. Rhizolysis was successful in 67% of patients with mechanical low back pain without evidence of disc herniation and nerve-root compression or psychogenic pain, who had not previously undergone an operation for relief of the pain.

Des douleurs lombaires basses peuvent apparaître à la suite d'altérations dégénératives des articulations postérieures de la colonne vertébrale. Ces articulations sont innervées par une ramification de la branche primaire postérieure, qui suit un parcours anatomique constant. Les impulsions douloureuses provenant de ces articulations peuvent être bloquées par coagulation du nerf par radio-onde, en plaçant la sonde en percutanée dans la région du nerf.

Une rhizolyse lombaire percutanée a été faite sous anesthésie locale en clinique externe chez 82 patients dont plusieurs subirent une rhizolyse à différents niveaux. La rhizolyse a été utilisée avec succès chez 67% des patients souffrant de douleurs lombaires mécaniques sans signe de hernie discale et de compression de la racine nerveuse ou de douleur psychogène, et qui n'avaient pas subi d'opération préalable destinée à soulager la douleur.

The most recent proposal for the treatment of backache has come from Rees¹ and Shealy,² who described the technique of percutaneous lumbar rhizolysis. On the theory that low back pain may arise from irritated or degenerated lumbar articular facet joints, they proposed that the facet joint be denervated at several levels. Rees produced denervation with a knife cut in the region of the facet joint and reported immediate relief of pain in 998 of 1000 patients with "intervertebral disc syndrome". Shealy introduced the procedure to North America but, after encountering a number of large hematomas, chose to induce radiofrequency coagulation through a probe placed in the region of the nerve supply to the facet joint. In one of his few reports on the subject Shealy² described a "90% success rate in 'virgin' back patients". He suggested that the procedure was useful for true disc herniations and "discogenic pain syndrome".

In this paper we describe the procedure and report our results with it in 82 patients.

Value of facet joint denervation

The theory of facet joint denervation is attractive. In a number of patients who underwent lumbar fusion without discectomy and reported immediate relief of pain Macnab (personal communication, 1975) attributed the relief to facet joint denervation. Other surgeons have reported that some types of back pain can be relieved by an injection of local anesthetic into the region of the facet joint.³

The role of the facet joint in the production of low back pain remains unknown. Pedersen, Blunck and Gardner⁴ first demonstrated the sensory nerve supply to the facet joints in 1956. It then became a simple matter to denervate these joints either with a knife or a radiofrequency current.

Denervation procedures alone for the relief of joint pain have not had a lasting good reputation among orthopedic surgeons. First, it is difficult to be sure, especially when doing a procedure percutaneously, that all the nerve supply to a joint has been cut. Probably the facet joint in the lumbosacral region receives branches from more than one nerve root;⁵ thus the single nerve lesion may not produce total denervation. Second, many structures in the lumbar region can give rise to pain and simple denervation of the facet joint will not affect some of these. Third, total denervation of an extremity or joint will often fail to relieve chronic pain. Fourth, low back pain is peculiar: if the supervising surgeon waits long enough and brings enough factors to bear on a situation (medication, brace support, weight reduction, job change,

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exercise), he can usually assist nature's plan — spontaneous remission, a factor difficult to incorporate when statistically reporting the efficacy of a mode of treatment.

Anatomic aspects⁶

Following union of the anterior and posterior nerve roots, the common nerve trunk splits into a larger anterior and a smaller posterior ramus. The posterior ramus passes backward on the side of a superior articular process and between two transverse processes. The first branch of the posterior ramus is the sinuvertebral nerve, which serves the ligaments of the spinal canal. The nerve to the facet joint separates from the posterior ramus after the latter has penetrated the intertransverse ligament. The facet nerve lies in a groove running inferiorly and medially on the lateral side of the superior facet, with smaller branches spreading out over the facet capsule (Fig. 1). The superior portion of the facet joint probably receives branches from the root existing from the level above.⁵

Technique

The procedure is done on an outpatient basis under local anesthesia. An image intensifier assists in placing the probe in an anterior-posterior and lateral plane (Fig. 2). An OWL RF Generator/Stimulator, Model RFS-1 (OWL Instruments Ltd., Downsview, Ont.) is used to localize the tip and make the lesions. With a stimulation frequency of 100 Hz and a voltage of 0.1 to approximately 3 V the tip is localized away from the anterior ramus (as evidenced by absence of leg pares-

thesias) and the surgeon is satisfied that he is working in the area where the patient has felt his back pain. Occasionally it is necessary to localize the tip higher than the facet joint at L3,4. The stimulus produces responses varying from local pressure to tingling or vibration but rarely produces the patient's pain.

Once the surgeon is satisfied that the probe tip is not too deep, is adjacent to the posterior ramus, and is stimulating an area recognized by the patient as painful, he produces, in 90 seconds, an elliptical lesion 1 cm in diameter. A current of approximately 25 V and 100 mA maintains a temperature of 80°C for 60 seconds. During the final 20 seconds the milliamperage is slowly increased until the current starts to decrease and the voltage to increase; the temperature increases above 90°C, which is necessary to ensure a complete lesion. Multiple lesions are produced because of the probable dual innervation of each facet joint. Lesions are made at two, three or, rarely, four sites on the patient's dominant painful side, then on the opposite side.

Patients

The emotionally stable patient with a herniated intervertebral disc, who does not respond to conservative treatment, has sciatica as manifested by leg pain on straight-leg raising, has neurologic changes of a segmental nature and frequently has a positive myelogram, usually does well with simple excision of the herniated or sequestered disc. Recent reports^{7,8} suggested that chemonucleolysis may also help these patients. We see no role for rhizolysis in such cases.

We offered rhizolysis only to patients with low back pain aggravated by activity and relieved by rest. We excluded patients with clinical evidence of nerve root involvement as described above, as well as patients with atypical historical features or inappropriate responses on physical examination suggesting psychogenic back pain.

Of the 82 patients selected 58 were men and 24, women. The average age was 50 years. All patients had had lumbar pain for at least 1 year and had not responded to standard conservative treatment measures, such as bed rest, bracing, muscle relaxants and physiotherapy. The pain usually had two components. The first was constant low-grade backache aggravated by bending and lifting and relieved by rest, and usually associated with a sensation of stiffness or a loss of flexibility, which was most pronounced in the morning on arising. The second component was intermittent acute episodes of severe, incapacitating back pain with "sciatic" scoliosis, the episodes lasting from a few days to a few weeks.

Physical examination invariably demonstrated loss of flexibility in the lumbosacral region as manifested by (a) loss of full flexion, (b) maintenance of lumbar lordosis on flexion, (c) pain on lumbar extension and (d) pain on attempts to sustain bilateral active straight-leg raising.

Findings on plain radiographs of the lumbar region varied from normal to serious degenerative changes affecting disc spaces and facet joints. Myelography was not done routinely but some patients had had myelography, with negative results, before being recommended for rhizolysis.

Follow-up after percutaneous lumbar rhizolysis lasted at least 6 months; the longest period was 20 months, and the average, 8 months.

Results

Results were classified as follows:

- Success
 - Excellent: Free of pain.
 - Good: Pain reduced and function increased substantially.
- Failure
 - No substantial change in pain or function.

Of the 82 patients 42 (51%) obtained a good or excellent result. Of

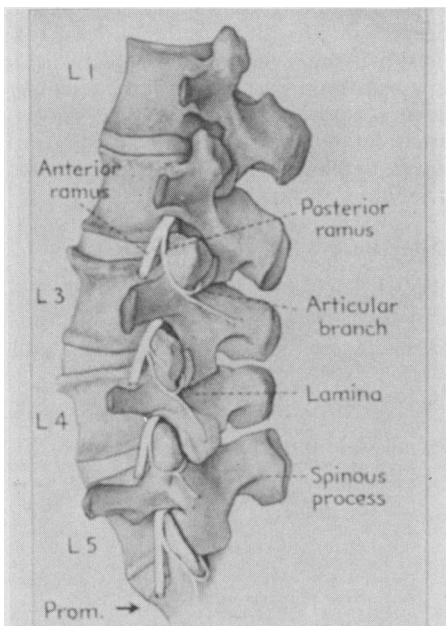


FIG. 1—Oblique view of dissection of posterior rami showing their relation to transverse process and lateral edge of superior facet.⁴

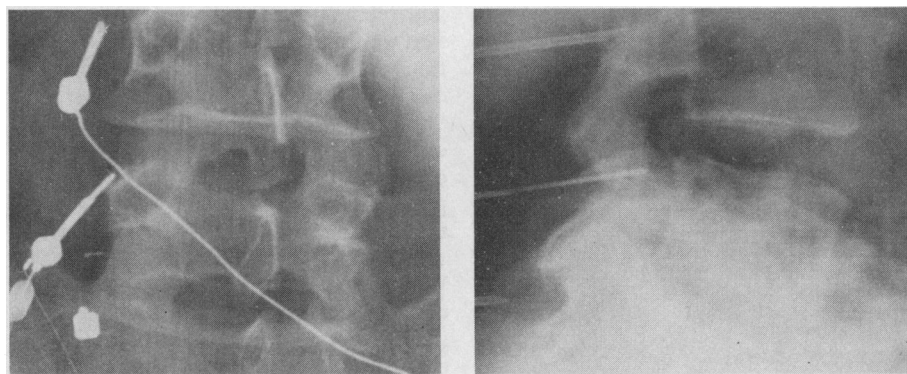


FIG. 2—Lumbosacral junction: left, anteroposterior view showing probe in angle between transverse process and superior articular facet of L5; right, lateral view showing depth of probe tip at L5.

32 patients receiving (or due to receive) Workmen's Compensation or with medicolegal aspects to their cases, only 34% obtained good results (Table I). Only 3 of 14 patients with postsurgical back pain obtained substantial relief of pain, and all 3 had obtained temporary relief with a local anesthetic block of multiple facet joints before rhizolysis. One patient with postsurgical pain had a good response to an anesthetic block of the facet joints but failed to respond to rhizolysis, one patient did not respond to either nerve block or rhizolysis, and the other nine were not given an anesthetic block before rhizolysis. There was some overlap of patients between the Workmen's Compensation Board/medicolegal and postsurgical groups.

Excluding the Workmen's Compensation Board/medicolegal and postsurgical patients, 67% of 46 patients obtained a good or excellent response. Of those with a successful outcome three required a second procedure for success. It is too soon to report on the long-term benefits of the procedure but, at the time of writing, two patients with a successful outcome had had a minor recurrence of some symptoms, although both stated that their pain was much less than before the procedure. Both patients localized the recurrence to the L5,S1 level and both were preparing for a repeat procedure at that level.

Of the 15 patients with an unsuccessful outcome who had not had previous surgery and were free of compensable claims, 3 should not have undergone rhizolysis. Two had a herniated intervertebral disc that was missed when they were selected and have since had successful chemonucleolysis. The other had stated that the stimulation at L5,S1 was not in an area where he felt pain, so rhizolysis was not done at this level. Subsequent discographic examination prior to chemonucleolysis (which was unsuccessful) revealed a degenerated disc at L5,S1 and normal discs at the two levels above, where rhizolysis had been carried out.

Table I—Results of percutaneous radiofrequency lumbar rhizolysis for low back pain

Patient group*	No. of patients		
	Total	Success	Failure
Mechanical low back pain without disc herniation	46	31	15
Postsurgical	14	3	11
Workmen's Compensation Board/medicolegal	32	11	21

*Ten patients included in both second and third groups.

In three patients with an unsuccessful outcome an insufficient number of sites were coagulated: two had rhizolysis at one level and one had single-sided rhizolysis on the basis of stimulation responses. In only one patient with a successful outcome was rhizolysis done at three levels on one side only; in all others rhizolysis was performed on both sides at a minimum of two levels.

Six patients with symptomatic degenerative disc disease without clinical evidence of sciatic nerve root involvement and without evidence of psychogenic back pain failed to respond to rhizolysis. In two the procedure was repeated and was again unsuccessful. No particular clinical picture or radiographic findings were prevalent in this group. Their failure to respond to rhizolysis suggests that the source of pain was outside the facet joints. The possibility of technically incomplete lesions must also be considered.

Of 10 patients with relief of sciatica but residual backache following chemonucleolysis 5 obtained a successful result with rhizolysis. All five patients in whom the procedure was unsuccessful had outstanding Workmen's Compensation or disability insurance claims.

No patient's condition was worsened by rhizolysis and no radiographic changes in disc space width or facet joint integrity were noted up to 20 months after the procedure. No complications occurred.

Discussion

As a treatment of low back pain, denervation of lumbar facet joints gives results that have ranged from almost 100% success¹ to 60% success in the postsurgical group of Oudenhoven.⁹ In the present study 42 of 82 patients selected for the procedure, after we had attempted to eliminate those with sciatic nerve root involvement and psychogenic reactions, obtained a successful result.

As in most studies evaluating treatment of low back pain, the patients with claims for Workmen's Compensation or other insurance or with contentious issues (motor-vehicle accident claims) outstanding did poorly. Surgical "failures" followed a similar course, only 3 of 14 having successful results of rhizolysis and all 3 having benefited previously from injection of local anesthetic into the region of the facet nerve and facet joint. We believe that, of Workmen's Compensation Board/medicolegal and postsurgical patients, only those responding to facet joint blocks at several levels should be considered for rhizolysis.

In a rigidly selected group of patients, from which individuals with

sciatic nerve root involvement (including the two initially missed in this series), inappropriate historical or physical findings, insurance support or outstanding litigation, or failure of previous operations have been excluded, approximately 70% obtained a good result. This suggests a limited role for rhizolysis in the management of low back pain.

The long-term benefit of rhizolysis remains to be determined through greater experience and longer follow-up. To date in this series two patients have had recurrences (at 8 and 9 months). The adverse long-term effects are also unknown. Theoretically, successful denervation of a joint should lead to a neuropathic joint with appropriate radiographic changes. These have not appeared to date in this series. As well, the facet joint is only one part of a multi-innervated lever arm, so the joint is protected following denervation.

Our attention was first drawn to this procedure because of 10 patients who had had relief of leg pain following chemonucleolysis but were left with some incapacitation due to residual backache. Five of these patients were relieved of their backache following rhizolysis. The use of two nonsurgical procedures to treat lumbar disc problems following failure of conservative treatment is a new dimension in the management of low back pain.

Conclusions

Having failed to duplicate the results of Rees¹ and Oudenhoven,⁹ we have concluded that radiofrequency percutaneous rhizolysis at several sites has a limited role in the management of low back pain. It appears to be of some benefit, in the short term at least, in most patients with organic mechanical low back pain who do not have sciatica, have not previously undergone an operation for relief of the pain and do not have psychogenic components to their disability.

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