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PERCUTANEOUS LUMBAR RHIZOTOMY FOR SPASMS IN PARAPLEGIA

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Summary. Twenty-one patients with myelopathy causing uncontrollable spasms of the legs underwent percutaneous lumbar rhizotomy. There were two groups: active, otherwise healthy people with spinal lesions whose rehabilitation was hampered by spasms of flexion or extension of the hips and knees; and a second group of hospitalised, debilitated paraplegic patients with unhealing decubitus ulcers.

Fourteen of the 16 active patients had excellent results initially, as did all five of the patients with pressure sores. Six have undergone repeat procedures in 7 to 18 months for recurrences of some component of the spasms. All have had at least minor recurrences. Of six patients with significant sensory preservation pre-operatively, four found the resulting numbness disturbing and two did not achieve good relief from the spasms.

The procedure is recommended when uncontrollable spasms interfere with rehabilitation or healing of pressure sores in patients with spinal lesions with complete motor and sensory loss.

Key words: Paraplegia; Reflex muscular spasms; Percutaneous thermocoagulation lumbar rhizotomy; Multiple sclerosis; Decubitus ulcers.

Introduction

ABNORMAL reflexes causing prolonged and forceful involuntary movement of the legs often develop after spinal cord injury. Light cutaneous stimulation of the legs or trunk may provoke violent movements which interfere with the patient's ability to dress, transfer in and out of a wheelchair, sit steadily, or even remain in bed without being tied down.

Many operations have been devised to control spasms of contraction of the leg muscles in paraplegic patients. Percutaneous rhizotomy was described by Uematsu (1977) and Kennemore (1978) for the treatment of pain as well as spasticity. Long term results have not been described in these reports.

Patients

Twenty-one patients with spinal cord lesions had percutaneous lumbar rhizotomy from 1978 until 1980 and all have been followed up for at least one year. These patients can be separated into three groups.

The largest group of ten had complete motor and sensory loss below the level of their spinal injuries, five of which were cervical and five thoracic. Their progress to independence was hindered by flexion, extension and adduction spasms of the hips and knees. All had extensive trials of

baclofen and dantrolene, drugs which have proved adequate in similar patients undergoing rehabilitation in the G. F. Strong Rehabilitation Centre concurrently.

The second group had similar problems as the first but had sensory sparing of varying degrees below the spinal lesion. Three of them had traumatic injuries, three had multiple sclerosis.

The third group of five came from hospitals where months of effort had failed to result in healing of decubitus ulcers over their greater trochanters. All had spinal injuries in the past and had developed the pressure sores at home. Spasms of hip flexion and adduction pulled the skin surrounding the ulcers taut and contractures prevented nurses from positioning these patients prone.

Operation

Number 14 needles are passed through the lumbar paraspinal muscles into the rostral half of the intervertebral foramina containing the second to fifth lumbar roots (Figure 1). The procedure is usually done under general anaesthesia even when the lumbar region is anaesthetic for otherwise spasms are provoked which move the patient and render fluoroscopic control difficult. Lateral fluoroscopy is used to guide placement, then the C-arm is swung to check the position in the antero-posterior projection. Using lateral imaging alone it is possible for one to inadvertently direct the needle into the spinal canal.

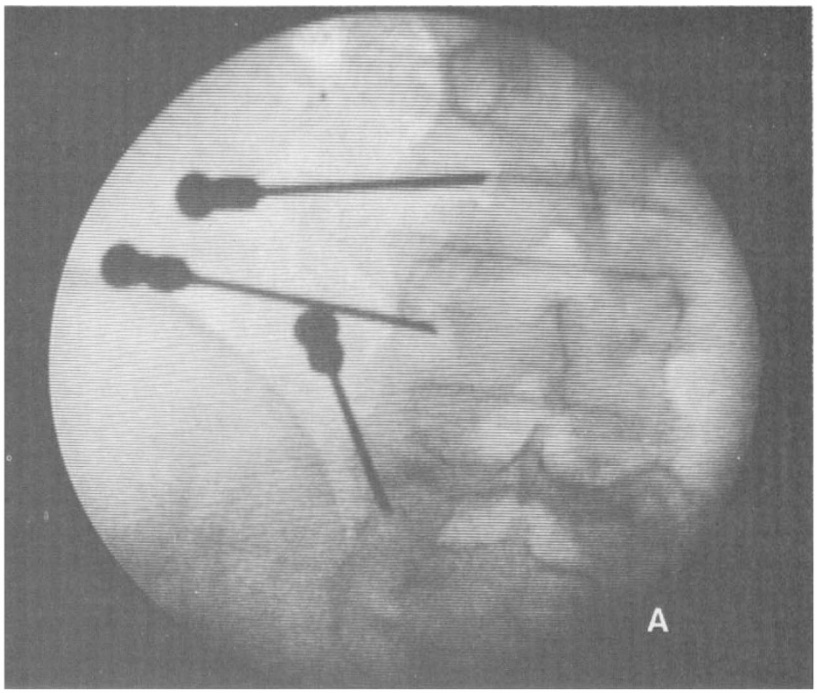
An electrode with a 7·5 mm exposed tip is passed through the needle. When the electrode tip lies on the root a low voltage 5 Hz stimulating current induces twitching in the muscles innervated by that root. A Radionics RFG-3AV Lesion Generator is used together with electrodes from the Radionics SRK/14 Spinal Rhizotomy Kit. With this equipment, stimulation at less than 0·8 volts will induce twitching if the electrode is on the nerve root. If the threshold is higher the electrode is moved until better contact is made.

Lesions are made at temperatures over 85°C. (the top of the temperature monitoring scale on the lesion generator) for 90 sec. Lesions are regarded as adequate when the threshold for stimulation-induced twitching is at least doubled. Otherwise the electrode position is changed a little and thermocoagulation is repeated.

Results

Table I summarizes the operative results. Resistance to passive movement of hips and knees disappeared within the range of motion set by contractures. Cutaneous touch either evoked no reaction or very weak movements in all who had good initial relief of spasms.

Some spasms returned in four to eight months in every individual. These were usually weaker than at first but when forceful the operations have been repeated, again with satisfactory results. At second operations some roots have been found to be unresponsive to low voltage stimulation. Always one or two roots have been found on the side of the recurrent spasms (usually both sides) that respond to low voltage stimulation. These roots have been then thermocoagulated once more. Even weak reflex



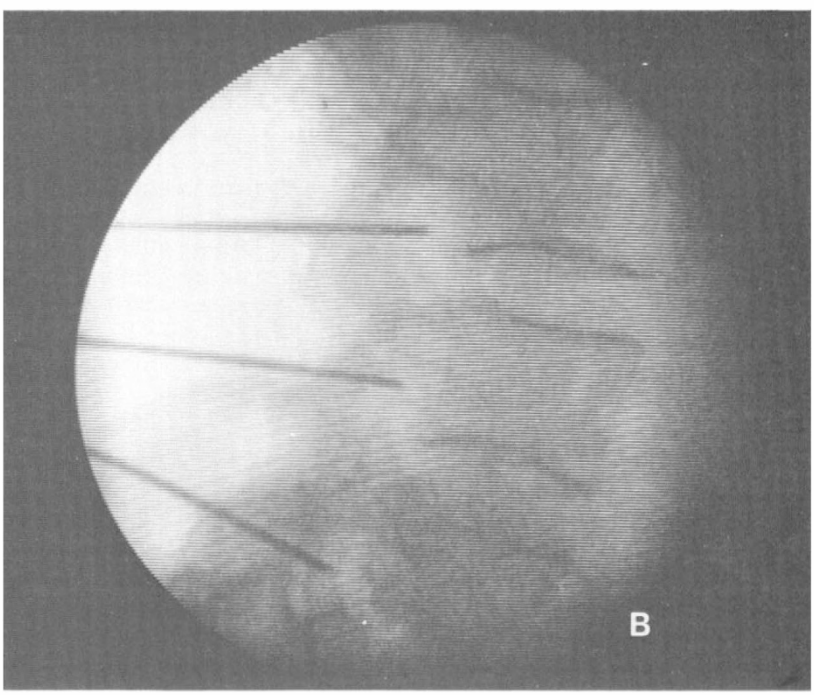


FIG. 1A and B:
AP and lateral fluoroscopic images showing needles in position for thermocoagulation of roots L3, L4 and L5.

Table I

Effect of percutaneous lumbar rhizotomy on spasms of leg muscles in 21 patients with spinal cord lesions

	Good initial relief of spasms	Late recurrence requiring re-operation
Active patients with complete motor and sensory loss	10/10	4/10
Active patients with sensory sparing	4/6	1/4
Bedridden patients with contractures and pressure sores	5/5	1/5

spasms after the initial operation presage early recurrence of bothersome spasms so latterly patients not completely flaccid after the first procedure have had the procedure repeated the next day. Little muscle wasting has occurred.

Stimulation during the first operations only evoked twitching in muscles known to be innervated by the root. At the second operation performed 7 to 18 months later other muscles sometimes contracted. The gastrocnemius was never induced to twitch at the first operation when roots L2–L5 were stimulated. During second operations, gastrocnemius contracted in three patients when roots L3 and L4 were stimulated.

Two problems have been identified in patients with sensory sparing. First, two patients, one traumatic and one with multiple sclerosis obtained little relief from the spasms. A woman with multiple sclerosis had the procedure repeated in two weeks but with so little benefit a longitudinal myelotomy was necessary.

All three patients with multiple sclerosis were disturbed by the numbness that ensued in their legs. Although touch sensation was preserved, it was reduced, and pin prick was abolished in the dermatomes of the roots treated. Two traumatic cases who had rudimentary sensation preoperatively did not notice numbness but the one with well preserved sensation complained afterwards of unpleasant, painful feelings.

Medical and surgical management of the decubitus ulcers was successful after the rhizotomies. Without spasms of flexion of the hips and knees being induced by cutaneous stimulation it became possible to work on the contractures with passive stretching, to prop the patients into a position in which they could remain for an hour or two without any pressure on the ulcers and to rotate skin flaps that would not be drawn taut.

Discussion

Percutaneous lumbar rhizotomy can be recommended for two groups of patients; healthy patients with complete paraplegia whose progress to independence is impeded by medically uncontrollable spasms of the legs and the debilitated with unhealing decubitus ulcers. The patient may return home, to a rehabilitation unit or to a medical ward as soon as the surgery is finished. There is no risk of the kind of wound infection that

may occur following a laminectomy on someone with infected ulcers.

Substantial sensory preservation below the spinal lesion constitutes a contraindication to percutaneous rhizotomy for the ensuing numbness may disturb the patient.

Tarlov (1967) described a patient with complete paraplegia caused by hydromyelia of the entire spinal cord secondary to an incomplete cervical cord injury. She developed hypertonus of the legs with flexor spasms which could not be relieved by opening the cyst to drain it into the subarachnoid space nor at a second operation by dividing lumbar posterior roots and transecting the cord at T12. Anterior rhizotomy relieved the hypertonus during this operation on the unanesthetized patient. Tarlov then excised the cystic lumbar cord and noted histologically a paucity of interneurons relative to motor neurons. This finding corresponded to his earlier experimental observation on dogs with hind limb hypertonus secondary to interneuronal destruction (Gelfan and Tarlov, 1959). The complete failure to relieve flexion spasms in one patient with multiple sclerosis can be attributed to the fact that in multiple sclerosis, unlike spinal injuries, the increased muscle tone of the legs may be largely the result of a loss of interneurons in the cord. For this reason, and because there usually is significant sensory preservation, percutaneous rhizotomy is not recommended in multiple sclerosis.

Bladder and bowel care can be difficult and sexual activity impossible for a paraplegic patient whose legs violently move when touched lightly. Since these functions depend upon sacral autonomic reflexes whatever method is used to suppress the muscle spasms must not disturb these reflexes. Although it is conceivable that percutaneous lumbar rhizotomy might result in damage to an important artery accompanying a root, the possibility of injury to the conus medullaris is less than following direct surgery on the lumbar spinal cord. Unlike phenol or alcohol, heat applied at the intervertebral foramen cannot spread to reach the lower sacral roots.

The finding of numbness in those with sensory sparing preoperatively indicates that the operation achieves at least part of its effect by sensory denervation. Although muscle wasting has not been noticeable the fact that the lesions are made where the motor and sensory roots run together would argue that the overall result is achieved by a partial motor as well as an incomplete sensory root lesion.

The observation that stimulation of mid-lumbar roots at second operations sometimes induces twitching in the gastrocnemius muscles may be evidence of spreading dendritic networks in the lumbosacral spinal cord in response to partial denervation.

Conclusion

Although recurrence of spasms is the rule, the facility of the percutaneous approach compared with surgery requiring a laminectomy gives the procedure a useful role in the management of spasms in the legs of paraplegic patients. Only some aspects of the original spasms recur. Having increased his upper limb strength with his rehabilitation program and having gained experience in wheelchair use the patient may find that he can handle the recurrent spasms without much difficulty. Pressures sores will have healed. But if the spasms are troublesome, he can have the procedure repeated.

RÉSUMÉ

Vingt et un patients souffrant de spasmes incontrôlables des membres inférieurs dus à une myélopathie ont subi une rhizotomie lombaire percutanée. Il y a deux groupes de malades: le premier est composé de patients actifs, d'autre part en santé, porteurs d'une lésion de la moëlle épinière et dont la réhabilitation est gênée par des spasmes de flexion ou d'extension des hanches et genoux; le second est constitué de paraplégiques débiles, hospitalisés, souffrant d'ulcères de décubitus chroniques.

Quatorze des seize patients actifs et les cinq patients avec plaies de lit ont connu d'excellents résultats initiaux. Six subirent une réintervention durant les sept à dix-huit mois suivants à cause de la réapparition de certaines composantes des spasmes. Tous eurent des rechutes au moins mineures. Six patients avaient une préservation sensorielle préopératoire significative et quatre d'entre eux se plaignirent d'engourdîssement post-opératoire troublant. Les spasmes de deux patients ne furent pas soulagés de facon importante.

Cette intervention est recommandeé lorsque des spasmes incontrôlables interfèrent avec la réhabilitation ou la guérison de plaies de lit chez des patients avec des lésions de la moëlle épinière causant une perte motrice et sensorielle complète.

ZUSAMMENFLASSUNG

Einundzwanzig Patienten, die wegen Rückenmarksschäden an unkontrollierten Beinkrämpfen litten, wurden einer perkutanen Lumbalrhizotomie unterzogen. Die Patienten bestanden aus 2 Gruppen: Solche mit läsionen, die sonst gesund and aktiv waren und deren Rehabilitierung nur durch Beuge- oder Streckkrämpfe von Hüften und Knien behindert waren, und Andere, Paraplegiker, die mit nichtheilenden Decubitusgeschwüren und heruntergekommen im Spital lagen.

Vierzehn der 16 aktiven Patienten hatten anfangs ein ausgezeichnetes Resultat, ebenso alle 5 der Paraplegiker mit Bettgeschwüren. Sechs benötigten in 7–18 Monaten eine Wiederholung der Rhizotomie wegen teilweiser Rezidive der Krämpfe. Alle Patienten hatten mindestens kleinere Rückfälle. Sechs Patienten, deren Gefühlssinn vor der Operation noch gut war, fühlten sich durch dessen Verlust beeinträchtigt. Zwei Patienten wurden durch die Operation nicht gebessert.

Lumbalrhizotomie ist empfehlungswert bei Patienten mit Rückenmarksschäden, die totalen motorischen and sensorischen Verlust haben und bei welchen unkontrollierte Beinkrämpfe Rehabilitierung oder das Heilen von Decubitusgeschwüren verhindern.

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