Selective Posterior Rhizotomy for the Relief of Spasticity in Cerebral Palsy

W. J. PEACOCK, LEILA J. ARENS

SUMMARY

Twenty children with increased muscle tone of cerebral origin have been subjected to selective posterior spinal rootlet section. A significant reduction in tone resulting in improvement in motor function was achieved in every case. The first 15 cases are reviewed in detail. The procedure is of value not only in the intelligent ambulant patient but also in the mentally retarded and severely spastic child because handling is facilitated and bladder and bowel control improved. Speech and hand function were improved in a number of patients in whom they had previously been major problems.

Resistance to movement due to increased muscle tone is a major problem in the child with spastic cerebral palsy. The aim of treatment has always been reduction of tone and facilitation of normal movement. In many cases this cannot be achieved by physiotherapy alone. Orthopaedic surgery plays a valuable role in the correction of fixed deformities and, to a lesser extent, reduces muscle tone, but does not affect the basic neurological imbalance. Neurosurgical procedures can normalize tone, thus improving function. The purpose of this article is to show that selective posterior nerve rootlet section reduces spasticity and improves function in spastic cerebral palsy.

PATHOPHYSIOLOGY

Skeletal muscle is composed of large extrafusal force-generating fibres which make up the main contracting mass of muscle and small intrafusal fibres of the muscle spindles which lie scattered throughout the muscle belly.[1] When the extrafusal fibres contract the muscle shortens and movement occurs. The muscle spindle is an adjustable sensory receptor which measures length and is involved in the subtle regulation of muscle tone and fine movement. The extrafusal fibres are innervated by large type Ia motor neurons arising from alpha anterior horn cells.

The intrafusal fibres of the muscle spindles respond to stretch by increasing the frequency of action potentials in their afferent sensory neurons. This afferent fibre connects directly or indirectly with the alpha anterior horn cells and facilitates its activity. Any increase in length of the muscle belly will therefore stretch the intrafusal muscle spindle fibres and via the spinal reflex the whole muscle will be forced to contract, thereby decreasing the stretch stimulus of the muscle spindle. The sensitivity of the muscle spindle can be altered. A small anterior horn cell, the gamma motor neuron, controls the length of the intrafusal fibres. The degree of stretch to which the muscle must be subjected before reflex contraction of the muscle as a whole occurs can therefore be adjusted. The afferent impulses from the muscle spindle are a major source of facilitatory influences on the alpha anterior horn cell. These impulses are continuous; it is only their frequency which varies, and this can be increased until the threshold of the alpha anterior horn cell is reached and an action potential is achieved.

The afferent neuron from the muscle spindle influences segments above and below its spinal cord segment to maintain agonist-antagonist balance according to Sherrington's law of reciprocal innervation.[2] Activity in distant segments is also affected to alter muscle tone and produce postural fixation. This is achieved by ascending or descending collaterals from the afferent neuron and via intersegmentary interneurons.

Suprasegmentary control from centres in the brainstem, cerebellum and cerebral hemispheres co-ordinates movement patterns, tone and posture. These influences are mediated via the pyramidal and extrapyramidal tracts. The descending tracts co-ordinate alpha anterior horn cell activity and inhibit gamma anterior horn cells, thereby suppressing tone in skeletal muscles.

There are therefore two opposing influences on anterior horn cells. Facilitation is brought about by the afferent fibres from the muscle spindle on the one hand, and on the other inhibition is the result of descending tracts from the higher centres. These two opposite forces must be precisely balanced to produce optimal muscle tone and posture.

In cerebral palsy the balance is upset. Descending

Departments of Neurosurgery and Paediatrics
University of Cape Town and Red Cross War Memorial Children's Hospital, Cape Town

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motor tracts have been damaged so that inhibition is reduced, leaving facilitation dominant; the excessive anterior horn cell activity produces spasticity.

TREATMENT

It should therefore be possible to relieve spasticity either by increasing inhibition or decreasing facilitation.[3] Theoretically, inhibition can be improved by stimulating the remaining neurons of the descending tracts; this is the rationale for the implantation of cerebellar stimulators. Ivan *et al.*[4] of the University of Ottawa School of Medicine carefully analysed their experience with 12 patients in whom these stimulators had been implanted. They found that 'chronic cerebellar stimulation did not noticeably alleviate symptoms and signs of cerebral palsy nor did it improve activities of daily living in a significant number of patients'.

If attempting to increase inhibition is ineffective, the alternative is to reduce facilitation. The most obvious and effective way of reducing spasticity is of course simply to divide the anterior spinal roots, but this has the disadvantage of causing flaccid paralysis and marked muscle wasting.

In 1898 Sherrington,[5] the great British neurophysiologist, rendered cats spastic by transecting their midbrains. This of course divided the descending tracts and removed the inhibitory influences on the anterior horn cells. He then sectioned the posterior roots of the spinal nerves and the spasticity disappeared. Foerster,[6] a German neurosurgeon, adapted this experimental work for clinical use in 1908 by dividing whole posterior nerve roots in the lumbar or cervical regions and successfully reducing spasticity in the leg or arm respectively.

Facilitation of the motor neurons can also be reduced by dividing the afferent neurons or the interneurons within the cord before they reach the anterior horn cell. Bischof[7] first described this technique in 1951. It consisted of a longitudinal section of the spinal cord in the coronal plane between the pyramidal and spinothalamic tracts from T12 to S1. Spasticity and flexor spasms were reduced, but because axons passing forwards from the pyramidal tracts to the anterior horns were also severed this procedure was not suitable for paraparetic patients who retained some useful movements. Bischof later modified his technique[8] to use a dorsal midline incision and a specially designed knife which could be rotated to produce a longitudinal coronal cut from within the cord, preserving the axons of the pyramidal tracts. Yamada *et al.*[9] used this technique in 14 paraplegic or tetraplegic patients , relieving mass spasms and hyperactive reflexes. Because the posterior rootlets are left undivided in this operation their ascending collateral branches remain intact to facilitate anterior horn cells at higher levels with incomplete reduction of spasticity.

In 1978 Fasano *et al.*[10] reported their results following selective stimulation of the rootlets which comprise a posterior spinal root. Rootlets which were associated with an abnormal muscular response were then divided. The reduction in spasticity was significant and functional improvement dramatic. This technique appeared logical and specific, and it was therefore decided to modify it and make use of it in Cape Town.

METHODS

Twenty children (aged between 22 months and 16 years) have been operated on, but only the first 15 will be reviewed because the follow-up period in the last 5 cases is considered to be too short to justify inclusion. The children belonged to all ethnic groups, Black, Coloured and White.

General anaesthesia with intubation is used and anaesthesia maintained without muscle relaxants, which would interfere with the response to electrical stimulation. The patient is placed in the prone position and recording electrodes are inserted into muscle groups of both lower limbs. Via a midline lumbar incision limited laminectomies are performed from the second to the fifth lumbar vertebrae, staying well medial to the posterior joints, which are essential for spinal stability. The dura is opened, exposing the filum terminale and the cauda equina. Using anatomical landmarks the second lumbar nerve root is isolated on one side and the posterior root is carefully separated from the anterior root.

With an electrophysiological system the posterior nerve roots are stimulated by placing two electrodes on the root at a distance of about 1 cm from each other, and the action potentials from the quadriceps and hamstring muscles are recorded. The nerve stimulator used has special intensity and pulse duration settings for applying both single and tetanic stimuli. Electromyographic potentials are recorded from the muscle groups using two concentric autoclavable needle electrodes and are displayed on an oscilloscope. The legs are exposed so that the contracting muscles can be identified and the type of movement observed. Any diffusion of contraction to other muscle groups of the same leg or even the opposite leg or trunk are noted. The responses in the muscles due to dorsal root stimulation fall into two groups. The type A or normal response is characterized by: (*i*) a single muscular contraction at 50 stimuli per second; and (*ii*) no diffusion of muscular contraction to muscle groups other than the one being stimulated. In the type B or abnormal response there is: (*i*) a tetanic muscular contraction at 50 stimuli per second; and (*ii*) a diffusion of muscular contraction to muscle groups other than those being stimulated.

If stimulation of the whole posterior root was associated with a type B response the root was gently split into its constituent rootlets and each rootlet then individually stimulated. It is believed that the rootlets showing the type A responses are not directly responsible for spasticity and that by saving them the afferent fibres useful for sensation and further motor re-education are preserved. The rootlets associated with the type B response, on the other hand, are probably part of abnormal circuits responsible at least in part for the maintenance of spasticity. These rootlets may contain more gamma afferent fibres from muscle spindles, or

alternatively may influence anterior horn cells that are inhibited by fewer intact descending tracts than the rootlets with normal responses.

Nerve rootlets showing the type A response are left intact and those showing the type B response are divided. The posterior nerve roots from L2 to S1 are dealt with in this manner on both sides.

PATIENTS AND RESULTS

Twenty patients have been operated on, all with good results. The 15 patients reviewed have been followed up for periods ranging from 4 to 16 months. Fasano *et al.*,[10] with their 7-year follow-up, had virtually no significant recurrence, and to date our experience coincides with theirs.

Quantitative analysis of spasticity is extremely difficult, so for this purpose experienced doctors and physiotherapists assessed the children before and after rhizotomy. Pre- and postoperative cinematographic records were made of each child, showing various motor functions such as sitting, standing, walking and hand movements. In addition each child was graded for independence, intelligence and motivation — the latter two factors were important for determining the rate of postoperative improvement. The patients were divided into two groups.

Group 1

This was composed of 7 heavily handicapped, dependent children with high muscle tone who were very difficult to manage. The aim of rhizotomy in this group was to reduce tone and facilitate handling. Each child's pre- and postoperative status is shown in Table I.

Four of the children in this group had spastic quadriplegia. Patients 2 and 13 had dystonic athetosis in addition to spasticity, while patient 4 had dystonic athetosis with no spasticity (he was selected because he was a severely handicapped but fairly intelligent child whose parents wished to institutionalize him because they could no longer manage him at home). All were of

Table 1. Group 1 — Severely Handicapped Children

Patient No.	*Sex*	*Age*	*Diagnosis*	*Pre-operative status*	*Postoperative status*	*Conclusions*
1	M	$8^{2}/_{12}$	SQ	*Spasticity:* Very marked — both legs and left arm, marked scissoring *Locomotion:* Nil *Sitting:* Supported in chair only *Supported standing:* In standing frame only *Hand usage:* Grasp and release with right hand *Speech:* Few single words	*Spasticity:* Greatly reduced in legs, no scissoring *Locomotion:* Nil *Sitting:* Independent in side-sitting, much better posture in chair *Supported standing:* Less easy to maintain *Hand usage:* As before *Speech:* More words, short sentences	General reduction of tone, improved sitting and speech, markedly easier to nurse (12 mo. postop.)
2	F	10	SDQ	*Tone:* Very high, mixed spasticity-dystonia *Locomotion:* Nil *Chair sitting:* Needed moulded seat *Supported standing:* Marked scissoring *Toiletting:* No sphincter control	*Tone:* Greatly reduced, no extensor spasms *Locomotion:* Nil *Chair sitting:* Moulded seat discarded *Supported standing:* no scissoring *Toiletting:* Full control	Died of unrelated pneumonia 3 weeks after discharge home. Prior to death was much easier to handle
3	M	4	SQ	*Spasticity:* Very marked all limbs *Locomotion:* None *Long sitting:* None *Stool sitting:* Sacral *Supported standing:* In extension, scissoring *Arm function:* Minimal, hand only *Seizures:* 3-4 per wk	*Spasticity:* Greatly reduced in lower limbs *Locomotion:* Moves across floor, rolls prone to supine *Long sitting:* Maintains with flexed knees *Stool sitting:* Not sacral *Supported standing:* Less support, normal tone *Arm function:* Uses for support, grasp, feeding and play *Seizures:* None since op.; on same medication	Improved in all aspects, much easier to manage, striking disappearance of seizures (10 mo. postop.)

Table I (Cont.)

4	M	$10^{4}/_{12}$	DQ	*Tone:* Fluctuating from low to very high, marked dystonic spasms *Head control:* Very poor *Locomotion:* Rolls using primitive kicking *Supported standing:* Total extensor pattern *Arm function,* speech: Nil *Feeding:* Very difficult — sloppy food only *Toiletting:* No sphincter control	*Tone:* Fluctuates from low to moderate, dystonic spasms still present *Head control:* Improved *Locomotion:* Achieves rolling without primitive kicking *Supported standing:* As before *Arm function,* speech: Nil *Feeding:* Much easier — can chew, gained 5 kg in 7 mo. *Toiletting:* Full control	Small but definite gains, easier to dress and nurse, child much happier — indicates that he feels looser, parents no longer wish to institutionalize him (9 mo. postop.)
6	M	$6^{3}/_{12}$	SQ	*Spasticity:* Very marked, all limbs *Head control:* Minimal *Locomotion:* Nil *Supported sitting:* Only in pushchair, sacral *Supported standing:* Nil	*Spasticity:* Greatly reduced in lower limbs *Head control:* Lifts head in supine position, better control in pull-to-sit and sitting *Locomotion:* Nil *Supported sitting:* With much less support, not sacral *Supported standing:* Wearing leg-gaiter support	Child less irritable, easier to position, nursing easier; mother very happy with improvement (7 mo. postop.)
9	M	$9^{5}/_{12}$	SQ	*Spasticity:* Very marked in all limbs, mass patterns *Locomotion:* Rolling with difficulty *Long sitting:* Supported sacral *Chair sitting:* Shoots into extension *Hand usage:* Minimal *Speech:* Almost unintelligible	*Spasticity:* Greatly reduced in legs, fewer mass patterns *Locomotion:* Much easier rolling *Long sitting:* Maintains, not sacral *Chair sitting:* More secure *Hand usage:* Much improved *Speech:* Greatly improved, intelligible	General improvement in tone and reduction of mass patterns, more interested and motivated, dramatic improvement in speech (6 mo. post-op.)
13	F	8	SDQ	*Tone:* Lower limbs very spastic, additional dystonic posturing upper limbs, marked dystonia, mass patterns. Dislocation of right hip *Rolling:* To one side, with difficulty *Side-sitting:* Maintained briefly *Sitting in pushchair:* Not secure *Supported walking:* Nil *Upper limb function:* Some grasp and release *Speech:* Nil	*Tone:* Much reduced, less dystonic posturing and more voluntary movement, still mass patterns when excited *Rolling:* Easier, to both sides *Side-sitting:* Maintains well when relaxed *Sitting in pushchair:* More secure *Supported walking:* Reciprocal stepping, hampered by shorter right leg *Upper limb function:* More control *Speech:* Nil	Much easier to handle, function generally improved but supported walking hampered by dislocated hip, still very handicapped by mass dystonic patterns when excited (4½ mo. post-op.)

SQ = spastic quadriplegia; SDQ = dystonic quadriplegia; DQ = dystonic quadriplegia.

below average intelligence. Two patients (Nos 2 and 6) were profoundly retarded, and patient 1 had very limited understanding.

In every case there was considerable improvement, and reduction in muscle tone made care and handling easier. Although the dystonic spasms were not abolished, tone was reduced even in the 3 children with athetosis. Most of the parents reported that the children were less irritable. Bladder control was achieved in 2 cases (Nos 2 and 4). Both children who had some speech before the operation showed considerable improvement. An unexpected gain occurred in patient 3 — pre-operatively he had had 3-4 seizures per week despite carefully planned anticonvulsant therapy, and in the 11 months since the operation there have been no further seizures. The parents of patient 4 were so pleased with his improvement after the rhizotomy, which had made feeding and handling easier, that they no longer wished to have him institutionalized.

Group 2

This group was composed of 8 children who were less dependent but had high muscle tone and were functionally handicapped because of spasticity. In these cases it was hoped to reduce muscle tone and improve function. The pre- and postoperative status of the children in this group is shown in Table II.

Three of the children had spastic quadriplegia and 4 spastic diplegia. One patient (No. 15) was a 17-year-old monoplegic who had been left with a severely spastic right leg because of brain damage caused by a motor vehicle accident at the age of 12; later subluxation of the right hip occurred and osteo-arthritis developed. Prior to rhizotomy the leg was drawn up in painful spasm and the patient could no longer voluntarily extend it. Patient 14 showed little spasticity on passive movement, but had a typically spastic diplegic gait.

Two children (patients 11 and 15) were of average to above-average intelligence; the remainder were slightly or moderately retarded.

Spasticity was reduced in all cases and greater mobility achieved. The patients who were able to walk independently (Nos 11 and 13) walked with a better pattern, and patient 15 regained the ability to walk unaided and is now able to play golf and dance. In 2 cases standing was improved, but 3 patients who had been able to stand with support using extensor spasm before the operation could no longer maintain supported standing because of quadriceps weakness. In these cases standing has been improved with a leg-gaiter support, and further improvement in muscle power is expected. In no case was the ability to walk with support lost. Hand usage was improved in 4 patients, and sphincter control improved markedly in 1 patient (patient 7). One child (patient 14) showed fewer gains).

COMMENTS

Fasano *et al.*[10] make the point that it is better to carry out rhizotomy before undertaking orthopaedic surgery to relieve fixed contractures. This is probably a sound principle, but the majority of our patients (10 out of 15) had undergone orthopaedic procedures prior to neurosurgery. A few will still need release of fixed contractures.

Voluntary muscle power must be carefully assessed before the operation. If voluntary power is poor spasticity may be useful in helping the patient to maintain the standing position, and its relief is then questionable.

Sensory loss as a result of posterior rootlet section was not a problem. A few of the children complained of 'numbness' in the legs during the first week or two after the operation. Clinical testing could not confirm any decrease in sensation, and the numbness soon disappeared.

COMPLICATIONS

There were no serious complications. The length of stay in hospital was 10 days on average, and the only complication which occurred was in patient 2, who developed postoperative urinary retention. With the aid of expression this was overcome.

CONCLUSIONS

Intensive physiotherapy and carefully planned orthopaedic procedures may not be sufficient for the relief of spasticity or its complications in cerebral palsy. This is probably because the fundamental imbalance within the central nervous system remains unaffected. In certain selected cases it may therefore be reasonable to use selective posterior rhizotomy in an attempt to equalize the facilitatory and inhibitory influences on the anterior horn cell and reduce spasticity.

With an electrophysiological system posterior nerve rootlets which are involved in spasticity-producing circuits can be selected and divided, leaving intact sufficient rootlets for normal cutaneous sensation and proprioception. We have found that selective posterior rhizotomy reduces spasticity and improves function not only in the local segments but also, because of ascending collaterals, in segments higher up the cord and in brainstem centres. Not only the intelligent, mildly spastic child can be helped, but also the retarded and severely handicapped child in whom handling is a problem.

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Table II. Group 2 — Mildly to Moderately Handicapped Children

Patient No.	Sex	Age	Diagnosis	Pre-operative status	Postoperative status	Conclusions
5	F	$6^{3}/_{12}$	SQ	*Spasticity:* Very marked in all limbs *Creeping:* On forearms, legs extended *Long sitting:* Nil *Chair sitting:* Not stable *Supported standing:* Not able to maintain *Tricycle riding:* On level surface *Hand usage:* Could not hold pen	*Spasticity:* Greatly reduced in legs, slight reduction in arms *Creeping:* As before, but also beginning to crawl *Long sitting:* Good except for fixed flexion deformity of both knees *Chair sitting:* Sits well *Supported standing:* Maintains briefly *Tricycle riding:* Up easy slope *Hand usage:* Writes, slowly but clearly	General improvement, especially in reciprocal leg movements and hand usage, fixed flexion contractions at knees and ankles will need orthopaedic correction (7½ mo. postop.)
7	M	$8^{9}/_{12}$	SQ	*Spasticity:* Very marked — all limbs *Creeping:* Forearms with extended legs *Sitting:* Sacral, needed triangular seat with abduction post *Supported standing:* With extensor spasm and scissoring *Supported walking:* With extensor spasm and scissoring *Arm function:* Poor, total grasp, limited supination *Toiletting:* Urination only in supported standing, constantly wet	*Spasticity:* Greatly reduced in lower limbs, somewhat reduced in upper limbs *Creeping:* No change *Sitting:* Not sacral, regular chair with chest strap *Supported standing:* No spasticity but maintains momentarily only *Supported walking:* Good active movements, no scissoring *Arm function:* Improved, pincer grasp, increased supination *Toiletting:* Can urinate sitting, remains dry	Considerable gains in sitting, supported walking and toiletting; poorly motivated — hinders progress (6½ mo. postop.)
11	M	$7^{9}/_{12}$	SD	*Spasticity:* Marked in legs *Long sitting:* Sacral *Standing:* Flexed knees and hips, lumbar lordosis *Walking:* Side-sway, lordosis, small stride, internal rotation of thighs, equinus feet *Running:* Severe lordosis and toe-drag *Hand usage:* very functional	*Spasticity:* Greatly reduced *Long sitting:* Still sacral because of fixed contractures of hamstrings *Standing:* Less lordosis, better balance *Walking:* Less sway, less lordosis, bigger stride, no equinus, less internal rotation *Running:* Greatly improved *Hand usage:* Subjective improvement	Child much happier, feels much looser, is more mobile, can jump and hop. Previously needed new boots with metal toe-caps every 4 weeks, now wearing sandals (5½ mo. postop.)
12	M	$7^{8}/_{12}$	SD	*Spasticity:* Marked in legs *Sitting:* Poor position and balance (floor and stool) *Crawling:* Legs too extended *Supported standing:* Flexed knees, internally rotated thighs, equinus feet	*Spasticity:* Greatly reduced *Sitting:* Improved position and balance *Crawling:* Improved mobility *Supported standing:* Feet now flat	In general moves more easily. Weak quadriceps for first months but strength has increased. Well motivated (6 mo. postop.)

Table II (Cont.)

				Supported walking: Flexed hips and knees, equinus feet. Can use walking aid *Riding tricycle:* Up slope	*Supported walking:* Longer stride; feet flat *Riding tricycle:* Poor after operation but now rides well	
14	M	7½	SD	*Spasticity:* Very little on passive movement except for calf muscles *Knee walking:* Severe lordosis, thighs internally rotated, shoulders retracted *Walking:* Typical diplegic walk — flexed hips, internally rotated thighs, feet equinus. Lordosis and arm retraction	*Spasticity:* Reduced in calf muscles *Knee walking:* Less lordosis and internal rotation, no change in shoulder retraction *Walking:* Less internal rotation, right foot flat, left toe-heel. Still lordosis and arm retraction	Small gains in walking patterns, very poorly motivated, no negative postoperative factors (3 mo. postop.)
8	M	$8^{2}/_{12}$	SD	*Spasticity:* Marked in legs, minimal in arms *Crawling:* Creeping only, with extended legs *Chair sitting:* Sacral, slips off. Dragged himself from prone to wheelchair, using spasms *Supported standing:* Using extensor spasm *Supported walking:* With severe scissoring and equinus *Hand usage:* Slightly clumsy, difficulty in dressing	*Spasticity:* Greatly reduced in legs *Crawling:* Crawling reciprocally *Chair sitting:* Good position maintained. Transfers well from prone to wheelchair *Supported standing:* Cannot maintain *Supported walking:* No scissoring, better active movements *Hand usage:* Improved, manages shoes, socks, buttons	Much improved functionally even though supported standing no longer maintained, well motivated — further improvement expected (6 mo. post-op.)
10	M	5½	SQ	*Spasticity:* Very marked both legs, left arm *Creeping:* On right forearm, legs stiffly extended *Long sitting:* Supported only, sacral *Stool sitting:* Sacral, legs shoot into extension *Supported standing:* With extensor spasm, scissoring, equinus feet *Hand function:* Grasps and releases with right hand only *Speech:* Nil, facial muscle high-toned	*Spasticity:* Greatly reduced at rest, still high (extensor) tone when creeping *Creeping:* No change *Long sitting:* Achieves and maintains well, plays without support *Stool sitting:* Not sacral, legs remain flexed *Supported standing:* Momentarily only. No scissoring, feet flat *Hand function:* No change *Speech:* Attempting words. Dribbling more	Considerable gains, especially in sitting; much easier to handle and treat, happier; quadriceps power insufficient for standing; handicapped by severely spastic left arm; poor motivation has limited progress (5½ mo. postop.)
15	M	17	RLM	Right lower limb drawn up in painful spasm, very difficult to examine. Good balance on left leg. Walks with crutches, hopping. Right hip subluxation, osteo-arthritis	Can now bear weight on right, pain much less severe, can walk unaided but prefers crutches. Can play golf and dance	Great improvement; much happier and more confident. Will still need orthopaedic treatment for hip (3½ mo. postop.)

SD = spastic diplegia; SQ = spastic quadriplegia; RLM = right lower monoplegia.

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Early Physiotherapy in Selective Posterior Rhizotomy

S. H. IRWIN-CARRUTHERS, L. M. DAVIDS, C. K. VAN RENSBURG, V. MAGASINER, D. SCOTT

SUMMARY

The general principles of the early treatment of post-rhizotomy patients are described and explained. The precautions to be taken and their rationale are given. Case histories are presented which illustrate the improvement of 4 patients.

OPSOMMING

Die algemene beginsels van die vroeë stadium van die behandeling na rhizotomie word beskryf en verduidelik. Die voorsorgmaatreëls wat getref moet word en hul rationale word gegee. Daar word gevalbeskrywings voorgelê wat die verbetering van 4 pasiënte vertoon.

INTRODUCTION

Selective posterior rhizotomies have been performed at the Red Cross War Memorial Children's Hospital, Cape Town, since 1981. The operative technique and the interim results with the first 15 patients are discussed in detail in the previous article.[1]

The operation reduces spasticity by interrupting the afferent input to the anterior horn cell via the posterior root. Only rootlets which produce an abnormal muscular response to electrical stimulation are divided. Since there are invariably some rootlets in each root which do not produce an abnormal reaction, and since there is considerable segmental overlap as regards the sensory supply, the eventual disturbance of sensation is minimal.[2,3,4]

All the rhizotomies performed at the Red Cross Hospital have been on spastic cerebral palsied children in whom the spasticity was significantly limiting function despite regular physiotherapy on neurodevelopmental lines. Criteria for the selection of patients for rhizotomy are the subject of a separate study and cannot be discussed in detail here, but as a general rule spasticity must be the main factor limiting function and the patient must have reasonably good underlying voluntary

S. H. IRWIN-CARRUTHERS, Nat. Dip. Physiother., Dip. Physiother. Educ.
Senior Lecturer and Head of Department of Physiotherapy, University of Stellenbosch
L. M. DAVIDS, B.Sc. (Physiotherapy), B.A. Hons, Dip. Ed. Physiother.
Control Physiotherapist, Red Cross War Memorial Children's Hospital.
C. K. VAN RENSBURG, B.Sc. (Physiotherapy)
Physiotherapist, Vista Nova School, Cape Town
V. MAGASINER, Dip. (Phys.) U.C.T.
Physiotherapist, Western Province Cerebral Palsy Association
D. SCOTT, B.Sc. (Physiotherapy)
Physiotherapist, Red Cross War Memorial Children's Hospital