DORSAL LONGITUDINAL MYELOTOMY

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Abstract. An evaluation of dorsal longitudinal myelotomy in the management of spasticity of the lower limbs has been done in 17 patients. The follow-up has varied from 1 month to over 2 years. Most patients achieved satisfactory relief from spasticity. Eight patients have died after the operation in chronic care hospitals. In all except one, the spasticity had been relieved. Eight out of the nine living patients have benefited from myelotomy. Recurrence of spasticity following the first operation occurred in four patients, two of whom improved after a repeat myelotomy. In the presence of fixed contractures of the hip and knee joints, a satisfactory clinical result may not be obtained after the myelotomy.

Key word: Longitudinal myelotomy.

Introduction

SPASTICITY associated with flexor spasms of the lower limbs may cause considerable annoyance to the patient and may pose a serious threat to nursing care. It also interferes significantly with rehabilitative goals in an already handicapped patient. Generally, various forms of drug therapy have been useless or have shown limited benefit (Monster *et al.*, 1973; Pederson, 1974; Jonsson *et al.*, 1975). Peripheral neurectomy (Freeman & Heimbürger, 1947), myotomy, and tenotomy, also, have not been uniformly successful. Though rhizotomies, both posterior and anterior, and cordectomy have relieved spasticity, the resulting sensory deficit, muscle atrophy, or both, have been undesirable (Foerster, 1913; Munro, 1945; Freeman & Heimbürger, 1947; Freeman & Heimbürger, 1948; McCarty, 1954). Similarly, the results of chemical rhizotomies have been inconsistent and unpredictable (Freeman & Heimbürger, 1948; Cooper & Hoen, 1949; Kelley & Gautier-Smith, 1959; Davis, 1975).

In 1951, Bischof described the technique of longitudinal myelotomy in the treatment of spasticity of the legs. Later, he modified his technique from a lateral to a posterior midline approach (Bischof, 1967). The operation involves separation of the anterior half from the posterior half of the spinal cord at T11-S1 segments in the central grey, thereby interrupting the poly- and mono-synaptic reflex arcs as well as the collaterals of Kolliker.

We are reporting our experience with midline dorsal myelotomy in 17 patients. The follow-up has ranged from 1 month to over 2 years.

Clinical Material

All the patients reported in this series were male and their ages ranged from 20 years to 72 years. The aetiology of spasticity was multiple sclerosis in nine patients, injury to the spinal cord in five patients with injury to the cervical spine in two and thoracic spine in three, Huntington's chorea in two patients and syringomyelia in one. All the patients were referred from peripheral chronic care hospitals.

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None of these patients had any useful movements in his legs. The sensory examination was abnormal in most of the patients with total to partial sensory loss in the lower extremities. Except for two patients with ileal loops and three patients with condom drainage, all the rest had indwelling catheters. Preoperative cystometrograms were carried out in seven patients only. A small capacity spastic bladder was noted in five while the remaining two patients had flaccid bladders. Trochanteric or sacral decubiti were present in almost all cases. Most of the patients had been on various spasmolytic agents including dantrolene sodium without any benefit. A brief summary of clinical survey is presented in Table I.

TABLE I

Age (yrs)	Diagnosis	Sensory loss	Follow-up (months)	Relief spasticity	Remarks
20	Cervical cord trauma	Complete	14	Satisfactory	Required reoperation—Dead
61	Thoracic cord trauma	Complete	16	Satisfactory	Dead
39	M.S.	Partial	24	Satisfactory	Dead
50	M.S.	Partial	22	Satisfactory	Alive
56	M.S.	Complete	6	Satisfactory	Dead
26	Cervical cord trauma	Complete	27	Satisfactory	Alive, mild recurrence
53	M.S.	Complete	24	Satisfactory	Dead
72	M.S.	Complete	5	Unsatisfactory	Required reoperation—Dead
49	Huntington's chorea	?	2	Satisfactory	Dead
29	Thoracic cord trauma	Complete	15	Satisfactory	Alive
52	M.S.	Complete	1	Satisfactory	Dead
41	Syringomyelia	Partial	9	Satisfactory	Alive
49	M.S.	Partial	8	Satisfactory	Alive
45	Thoracic cord trauma	Complete	7	Satisfactory	Alive
55	M.S.	Partial	4	Satisfactory	Alive, required reoperation
45	Huntington's chorea	?	3	Unsatisfactory	Severe contractions of hip and knee—Alive
24	M.S.	Partial	2	Satisfactory	Alive

Operative Technique

Under general endotracheal anaesthesia with the patient in prone or lateral position, a laminectomy is made from T10 to L1. After the dura mater is opened in the midline, the operative microscope is brought into the field and under 10× magnification, the arachnoid membrane is opened in the midline. The tip of the conus medullaris is visualised and the S1 root (largest root) is followed into the spinal cord. The midline dorsal longitudinal vein and the pia mater are then coagulated with the low current bipolar coagulator starting from S1 segment and proceeding cephalad to the emergence to T11 or T12 root. An incision 3 mm in depth is then made with a sharp knife or razor blade in the entire length of the spinal cord from T11 or T12 to S1 level. The myelotomy knife is then inserted first on one side and myelotomy carried out longitudinally. The process is then repeated on the other side (fig. 1). The myelotomy is then carefully inspected

FIG. 1

Shows the technique of myelotomy.

for its adequacy. The bleeding usually is minimal and can be easily controlled with gentle pressure. The dura mater is then closed.

Results

All patients had initial relief from spasticity except Cases 1, 8 and 16. Persistence of spasticity on one side in Case 1 required repeat myelotomy a few months after the initial procedure with satisfactory results. In the interim period, chemical rhizotomy with absolute alcohol had been tried without success. In Case 8, reoperation was performed within 2 weeks of the initial procedure because of the unrelieved spasticity. Following the second operation, the hip contractions were partly abolished in this patient. The clinical result was considered unsatisfactory because of the unrelieved fixed contractures of the knees and the hip. Similarly, Case 16 was a failure because of the severe contractures of the hip and knee on the right side. A recent case (Case 15) was initially considered unsatisfactory as the spasticity returned soon after the operation. This patient was operated upon a second time with relief of spasticity, but the ankle jerks persisted, suggesting inadequate caudal extent of the myelotomy. Out of 17 patients, eight have died from 1 month to 2 years after the operation. All except one of these patients were considered to have obtained satisfactory results. The cause of death was either renal failure, pulmonary infection, or septicemia in seven patients. One patient died of massive haemorrhage due to erosion of the internal carotid artery at the tracheostomy site.

Seven patients had preoperative cystometrograms, a follow-up cystometrograms in the postoperative period was carried out in four patients. The bladder status was unchanged in three, whereas in one patient, the bladder had become flaccid from a spastic state. It was also noted that patients who had external catheters before had to have an indwelling Foley catheter for a few weeks after the operation. Later, the external drainage was re-established in all such patients.

The sensory loss was complete in nine patients. Five of these had injury to the spinal cord, with sensory level at C5 in two patients and at T9, T4, and T3 in the remaining three patients. The other four patients had longstanding multiple sclerosis with asymmetric sensory levels in the mid-thoracic and thoracolumbar regions. The sensory examination was unreliable in the two patients suffering from Huntington's chorea because of their marked dementia. The remaining patients had partial preservation of sensation in the lower limbs.

Discussion

Over the years, a wide variety of surgical procedures have been used to control spasticity and flexor spasms of the lower extremities with variable results. The effect of posterior rhizotomy has been short lasting and disadvantageous as it increases the sensory deficit. The anterior rhizotomy advocated by Munro (1945) though relieving spasticity, leads to muscular atrophy and precludes permanently any future hope of recovery of motor function. Similarly, selective cordectomy (McCarty, 1954) has resulted in permanent destruction of functions of the spinal cord with abolition of reflex activities for bladder, bowel and erection. Since the description of a more physiological approach of relieving spasticity while retaining residual function by Bischof (1951, 1967) several authors have applied the technique with encouraging results (Tonniss & Bischof, 1962; Ivan *et al.*, 1967; Moyes, 1969; VanderArk & Kempe, 1969; Laitinen & Singounas, 1971; Yamada *et al.*, 1972; Davis, 1975; Ivan & Wiley, 1975).

Feurer *et al.* (1972) studied the anatomical and histological changes following longitudinal myelotomy in dogs. They noted interruption of the connection between the anterior and posterior horn cells. Considerable damage was noted in the posterior horn cells along with degenerative and regenerative changes in the anterior horn cells. They observed that normal dogs undergoing myelotomy became temporarily paraparetic, but regained walking ability within 2 weeks after surgery. Several experimental modifications of the original myelotomy technique have been performed by Ivan (1975) in an attempt to section the cord more precisely within the central grey matter.

We have followed the dorsal midline approach for its suggested advantages (Laitinen & Singounas, 1971) especially its possible sparing of the connections between the pyramidal tract and the anterior horn cells. Preservation of the motor pathways may allow recovery of the motor function after myelotomy as was noted by Laitinen and Singounas (1971). None of our patients, however, showed any improvement of volitional motor activity following the operation.

The persistence or recurrence of spasticity, following the first myelotomy, occurred in four of our patients. Subsequently, the myelotomy was repeated in three with satisfactory results in two of these cases. During reoperation, the myelotomy was extended cephalad in each case. The poor clinical results in the remaining two patients (Cases 8 and 16) were attributed to the presence of fixed contractures of the hip and knee joints. A resection of the joints in such cases may offer better results as has been suggested by Ivan and Wylie (1975).

Several authors have noted preservation of residual sensory function post-operatively if such was the status prior to the operation (Tonnis & Bischof, 1962; Moyes, 1969). An increased impairment of sensation following operation has also been observed. In most cases, sensations have recovered spontaneously (Laitinen & Singounas, 1971). In our cases with partial sensory loss, some preservation of sensation in the lower limbs was noted after the operation.

Tonnis and Bischof (1962) and others (Moyes, 1969; Laitinen & Singounas, 1971; Davis, 1975) have noted preservation or improvement of bladder functions following myelotomy. As can be seen in Table I, none of our patients improved significantly in bladder function following myelotomy. A deterioration of bladder function was noted in the immediate postoperative period in three of our patients who wore condom catheters. In these patients, a Foley catheter had to be used for a few weeks after the operation. Later, external drainage could be re-established. Others have also noted temporary worsening of the bladder function in the post-operative period with either recovery or permanent worsening (Moyes, 1969; Laitinen & Singounas, 1971). It has been suggested that a unilateral downward extension of the myelotomy from S1 to S5 segments may be done for a spastic bladder. This was not done in any of our cases. In one patient, however, a spastic bladder became flaccid about 2 weeks after the myelotomy.

Although our longest follow-up has been only a little over 2 years, we feel that dorsal longitudinal myelotomy is an effective measure in the management of severe spasticity of the lower limbs. In other series in which the patients have been observed for much longer periods, the flaccidity has been maintained (Tonnis & Bischof, 1962; Moyes, 1969; Laitinen & Singounas, 1971; Ivan & Wylie, 1975). The management of recurrent spasticity following myelotomy depends on its severity and, at times, the myelotomy may need to be repeated. In the presence of severe contractures of the joints, the myelotomy may not be successful in improving the condition of the patient.

RÉSUMÉ

Une étude de la myélotomie dorsale, longitudinale dans le traitement des états spastiques des extrémités inférieures a été entreprise chez 17 patients. Ils furent suivis durant une période post-opératoire variant d'un mois à plus de deux ans. La plupart des malades bénéficièrent d'une amélioration de leur spasticité. Dans les suites opératoires, huit patients sont décédés dans des institutions de soins chroniques. A l'exception d'un seul, ils étaient tous soulagés de leur état spastique. Huit des neuf survivants ont bénéficié de la myélotomie. L'opération fut suivie de récidence chez 4 malades, dont deux furent améliorés par une seconde myélotomie. En présence de sévères contractures de la hanche et du genou, la myélotomie peut ne pas entraîner un résultat clinique satisfaisant.

ZUSAMMENFASSUNG

Die dorsale longitudinale Myelotomie für die Behandlung von Spastizität der Beine wurde in 17 Patienten mit Nachuntersuchung von einem Monat bis über zwei Jahre ausgewertet. Die meisten Patienten erreichten befriedigende Linderung von der Spastizität. Acht Patienten sind nach der Operation in chronischen Krankenhäusern gestorben, aber in nur einem war die Spastizität nicht gelindert. Acht von den neun lebenden Patienten haben von der Operation einen guten Resultat erreicht. Spastizität ist in vier Patienten nach der ersten Operation wieder eingetreten. Zwei von diesen wurden nach einer zweiten dorsalen Myelotomie wieder gelindert. In der Anwesenheit von schwerer, fester Beugekontraktur des Hüften- oder Kniegelenks mag ein befriedigendes klinisches Ergebnis von der Operation nicht erricht werden.

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