Longitudinal Myelotomy for Spasticity

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Various patterns of spasticity occur according to the level of total or partial lesions of the brain stem and spinal cord. Stated simply, spasticity occurs because spinal reflex arcs are separated from the controlling influences that normally reach them from higher in the central nervous system. Sensory impulses may then produce either an exaggerated stretch reflex which results in spasticity or an exaggerated flexor withdrawal reflex which results in flexor spasms. Furthermore, in partial lesions a voluntary effort to move a limb may increase the activity of motor units and thus contribute to uncontrollable spasm.

In some patients the considerable degree of spasticity and tendency to violent flexor spasms have a serious effect upon rehabilitation. These patients have difficulty in carrying out such procedures as transferring to and from a wheel chair or in wearing braces. They are also more liable to develop permanent deforming contractures. Excoriation and ulceration are more common, and in certain circumstances the violent muscular spasms may be painful. In certain paraplegic, quadriplegic, or paraparetic patients, this problem negates all efforts at rehabilitation.

Many procedures have been tried over the years to combat this spasticity, and the multitude of procedures indicates that none are entirely satisfactory.

In 1913, Foerster advocated division of the posterior roots of L-2, -3, and -5, and S-1 in order to interrupt the afferent sensory component of the reflex arc. This procedure was usually followed by relief of spasticity for some time, but it eventually returned. This was presumably due to some afferent impulses still finding their way to the anterior horn cells via the extensive collateral system.

Anterior rhizotomy, described by Munro in 1945, and cordectomy, described by McCarty and Kiefer in 1949, have the disadvantages of producing marked wasting of the muscles of the legs and loss of voluntary bladder function if this was present preoperatively.

Intrathecal injections of phenol or alcohol appear to give only temporary relief and are best suited to terminal cases, where no long-term effect is necessary. Repeat injections become progressively less effective owing to the reactive arachnoiditis and localization of the subarachnoid space.

Other procedures that have been used include peripheral neurectomies (commonly used on the obturator nerve), partial neurectomies, and many forms of tenotomy and myotomy. Spinothalamic tractomy has also been used in an effort to eliminate pain. None of these procedures has met with any uniform success, and the problem is still a very difficult one.

In 1951, Bischof first described a new procedure in the treatment of flexor spasms. There have been several other reports of experience with this procedure.

Bischof's myelotomy consists of a longitudinal section of the lumbosacral spinal cord in a horizontal plane between the pyramidal tract and spinothalamic tract (Fig. 1). This is carried out over an area extending from the point of emergence of the first lumbar roots above to that of the first sacral roots below. When a spastic contracted bladder is a prominent feature, the incision in the cord is extended to S-5 on one side only. The myelotomy separates the dorsal half of the cord from the ventral half. Some continuing function of the long tracts is still possible, but the reflex arc between the sensory and motor roots is interrupted and the collaterals of Kölliker are also divided. If the myelotomy is sufficiently extensive, there is no recurrence of spasticity.

Received for publication January 31, 1969.
Revision received May 15, 1969.
* This paper was written in collaboration with L. P. Ivan, M.D., K. W. Paine, M.D., W. M. Lougheed, M.D., R. R. Tasker, M.D., R. Fleming, M.D., P. O. Lehmann, M.D., T. P. Morley, M.D., and C. Drake, M.D.
In their paper in 1962, Tönnis and Bischof reported 20 cases. All patients had initial relief of spasticity but it returned in five cases. Two of these five had repeat myelotomies with lasting benefit. It was considered that 17 of the 20 patients experienced successful alleviation of spasticity. The patients were followed from 2 to 8 years, the majority of cases for 4 to 5 years. Of the 20 patients, 18 had been confined to bed before operation; only three remained bed patients after operation, and four were able to walk after a fashion.

Bischof and Tönnis' chief interest has been the preservation of voluntary bladder function or a satisfactory reflex bladder function, and they reported some cases of significant improvement of bladder function due to relief of hypertonia of the bladder muscles. As with the limbs, bladder difficulties seemed more troublesome in cases of partial rather than total cord lesions. Furthermore, there is some preservation of motor and sensory functions of the legs if this was the status before operation. Bischof and Tönnis also point out that it is usually very difficult to assess the amount of potential voluntary movement in the presence of severe spasticity so that relief of spasticity may reveal greater motor function than had been anticipated. Nevertheless, they do not feel that this myelotomy should be carried out on patients who can walk at all well.

This type of myelotomy is performed through a laminectomy of T-11, T-12, and L-1 and made sufficient to expose the lumbar segments and the conus medullaris. After the dura is opened, the lumbar and sacral segments should be identified with a nerve stimulator. The largest root is usually S-1, and this leads the surgeon to the first sacral segment of the cord. Localization may be confirmed by electrical stimulation. After identification of the other appropriate nerve roots and related segments, the cord is rotated slightly and an incision made in a longitudinal plane (Fig. 2) from the T-12 to the S-1 segment, approximately in line with the attachment of the dentate ligaments (Fig. 3). A special knife may be used for this purpose, and a straight needle passed through the cord helps establish the correct plane. Hemorrhage from the procedure is usually minimal and is readily controlled by

Fig. 1. Operative diagram of longitudinal myelotomy. Incision is made into the cord with the dentate ligaments grasped by forceps and the spinal cord rotated slightly.

Fig. 2. Operative diagram of longitudinal myelotomy. Incision is carried through the cord in a horizontal plane.

Fig. 3. Operative diagram of longitudinal myelotomy. The horizontal incision into the cord extends from L-1 to S-1, with the optional extension on one side to approximately the S-5 level.