Simultaneous Microsurgical DREZ-otomy of Cervical and Lumbosacral Spine for Tetra-Spastic Status with Double Hemiparesis

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Abstract

Apart from its established role in treatment of neuropathic pain following brachial plexus avulsion injuries, microsurgical dorsal root entry zone (DREZ) lesioning have also been used for treatment of spasticity in both upper and lower limbs. Simultaneous DREZ-otomy of cervical and lumbosacral region to relieve spasticity of bilateral upper and lower limbs have not been reported in the literature. In this case report, we will discuss such a case that underwent simultaneous DREZ-otomy of cervical and lumbosacral region along with review of the literature.

Keywords
- DREZ
- spasticity
- cervical
- lumbosacral

Introduction

Spasticity is a common neurological problem that often occurs after a variety of neurological disorders like stroke, traumatic brain injury, spinal cord injury, or cerebral palsy that adversely affects patient functional status and caregiving.[1-5] Patients who show no or minimal improvement in debilitating spasticity after conservative treatment (drugs and aggressive physiotherapy) should be offered neuromodulation therapy (intrathecal baclofen pump) or neuroablative treatment options like dorsal root entry zone (DREZ) lesioning or selective dorsal rhizotomy (SDR).[6-8] Because of high cost and availability issue of intrathecal baclofen pump in developing countries like India, neuroablative procedures can play a vital role in management of spasticity in such conditions. Besides being a less destructive procedure than SDR, microsurgical DREZ-otomy is particularly helpful in relieving pain as well as severe spasticity in nonambulatory bedridden patients.[9] Simultaneous DREZ-otomy of cervical and lumbosacral region to relieve spasticity of bilateral upper and lower limbs have not been reported in the literature.

Case Discussion

A 13-year-old boy was admitted to our hospital with severe disabling spasticity involving all four limbs. He was previously operated upon for congenital atlantoaxial dislocation with severe basilar invagination (underwent surgical decompression with posterior cervical instrumentation) one year earlier in our institute. Although after surgery he showed gradual improvement in his motor weakness, his spasticity and pain remained static, even with aggressive physiotherapy. On neurological examination, the patient was conscious and cooperative and tetraspastic status with double hemiparesis with modified Ashworth scale (MAS) 4 in the right upper and lower limb, MAS 3 in the left upper limb, and MAS 2 in the left lower limb.

Radiological investigations of the spine in the form of magnetic resonance imaging (MRI) and computed tomography (CT) scans showed no evidence of nerve root or spinal cord compression. MRI brain was also normal. Patient was given the option of placement of an intrathecal baclofen pump to relieve spasticity, but citing financial constraints, his relatives opted for surgical intervention.

Surgery

Patient was planned for simultaneous microsurgical DREZ-otomy of cervical and lumbosacral region to relieve bilateral upper and lower limb spasticity, after explaining the risks involved. After positioning the patient prone, first cervical microsurgical DREZ-otomy was done. The procedure has been described previously.[1] In brief, in this case the previous

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vertical midline skin incision was extended to expose C3–T1 spinous processess. A C3 to T1 laminectomy was done. Dura opened in midline. DREZ-otomy was done bilaterally from C4 to D1 level using only microscissors (►**Fig. 1**). Lesions were made at the ventrolateral side of the entry of dorsal rootlets into the dorsolateral sulcus, 3 to 5 mm in depth, at an angle of 35 degrees, in the axis of the gray matter of the dorsal horn. After meticulous hemostasis, dural closure was done using Prolene 5/0 suture (Ethicon Inc.). Wound closure was done in layers. After closure of the cervical skin incision, a vertical midline skin incision was given from D11 to L2 level. D12 to L1 laminectomy was done. Dura and arachnoid were opened longitudinally. The filum terminale was identified. To obtain adequate access to the lateral aspect of the DREZ in the posterolateral sulcus, all the dorsal roots of the cauda equina on one side were displaced dorsally and medially. A posterolateral sulcotomy (continuous incision) was then performed from L1 to S2 bilaterally using microscissors and fine-tip bipolar coagulation, preserving posterolateral spinal artery (►**Fig. 2**). After achieving meticulous hemostasis, dural closure was done using prolene 5/0 suture. Wound closure was then done in layers.

Postoperative period was uneventful. He was discharged home on the seventh postoperative day with marked improvement in spasticity and pain in all four limbs. At the time of discharge, MAS was 2 in all four limbs.

Discussion

Gate control theory for the pain pathway was proposed in 1965, which laid the foundation stone for DREZ as a possible target for pain surgery. Subsequently, in 1972 Sindou et al performed microsurgical lesioning of DREZ to relieve neuropathic pain in a patient suffering from Pancost tumor that infiltrated the brachial plexus.[9-12] Several years later Nashold et al used radiofrequency electrode in DREZ lesioning in four patients with brachial plexus injury for neuropathic pain.[7,9-12] Subsequently, DREZ-otomy has been applied in the treatment of several intractable painful conditions like postherpetic neuralgia, cancer pain, cauda equina, and/or spinal cord lesions especially for pain corresponding to segmental lesions.

The DREZ-otomy procedure for the control of neuropathic pain as described by Sindou et al consists of an incision and bipolar coagulations performed ventrolaterally at the entrance of the rootlets into the dorsolateral sulcus under the surgical microscope.[9-12] The incision is ~2 mm depth at an angle of 45 degrees medially and ventrally (lesioning penetrates the lateral part of DREZ, and the medial part of tract of Lissauer (TL) and extends down to the apex of dorsal horn.

It causes selective destruction of the nociceptive fibers grouped in lateral division, excitatory medial fibers of tract of Lissauer, and hyperactive neurons of dorsal horn, while preserving most lemniscal presynaptic fibers, the lateral (inhibitory) portion of TL, and most of the dorsal horn.

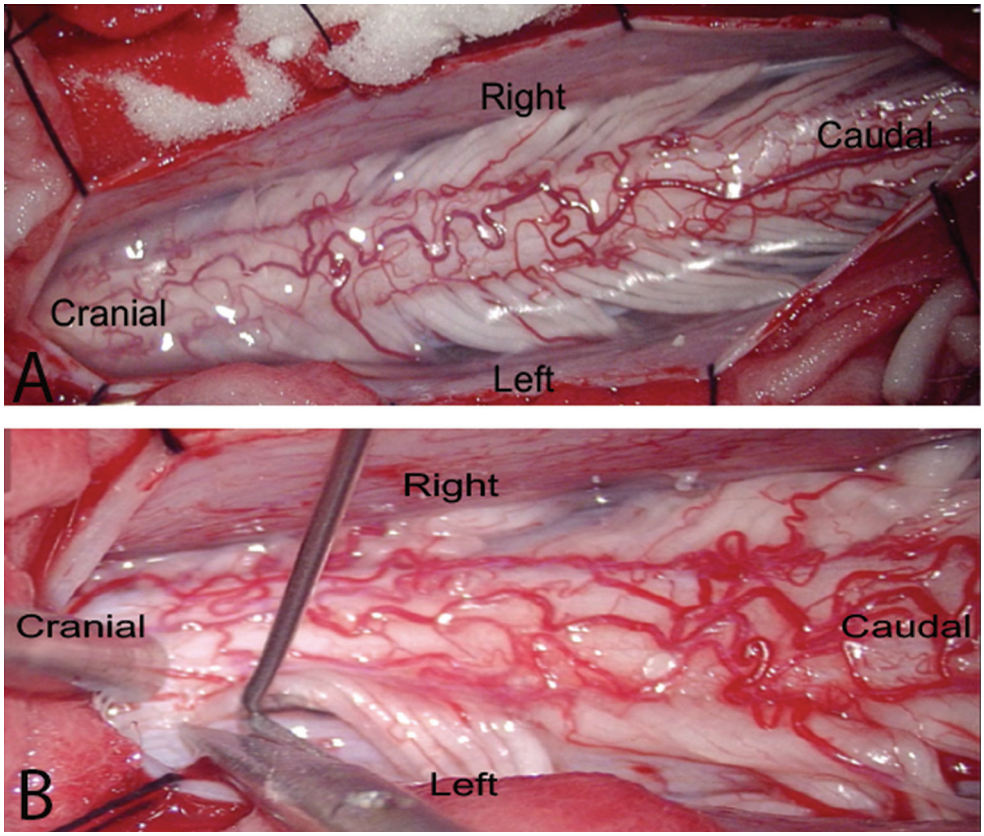

Fig. 1 Left-sided cervical microsurgical dorsal root entry zone (DREZ) lesioning. (**A**) Exposure from C4 to D1 nerve roots bilaterally. (**B**) DREZ-otomy was done at the ventrolateral side of entry of dorsal rootlets into the dorsolateral sulcus.

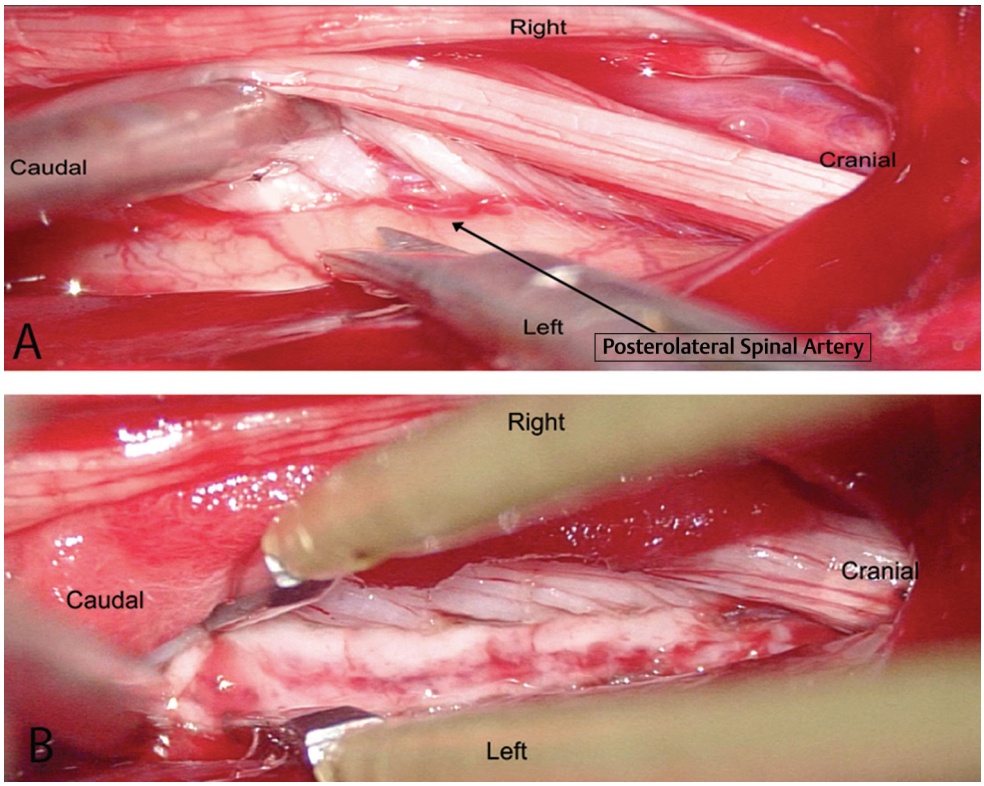

Fig. 2 Left-sided lumbosacral microsurgical dorsal root entry zone (DREZ) lesioning. (**a**) Dorsal roots of the cauda equina were displaced dorsally and medially to obtain adequate access to the lateral aspect of DREZ in the posterolateral sulcus. (**b**) Continuous posterolateral sulcotomy from L1 to S2.

In addition to the relief in neuropathic pain after DREZ-otomy, Sindou et al also observed that there was a decrease in muscular tone in the operated territories. Therefore, in 1973 he applied this procedure to relieve spasticity. Forty-two patients underwent MicroDREZ-otomy at the cervical level (C5-T1) for hyperspasticity in the upper limb; 93 were operated on at the lumbosacral level (L2 to S2 or sometime to S4) for excessive spasticity in severe paraplegic states. In a follow-up period of 2 years, there was a significant decrease in tone, allowing easier passive mobilization along with reappearance of some voluntary moments hidden behind hypotonia in ~82% of the patients.[9-12] He hypothesized that the improvement in spasticity was due to interruption of the afferents of both the myotatic (monosynaptic) and the nociceptive (polysynaptic) reflexes that deprives the somatosensory relays of the dorsal horn of most of their excitatory inputs. However, improvement in tone was associated with mild decreased sensation in 40%, marked in 40%, and severe in 20% of the patients in the operated territories by DREZ-otomy and death occurred in five patients. Therefore, from his experience he advocated the following recommendations for microsurgical DREZ-otomy for spasticity.

1. For hyperspastic hemiplegic upper limb: This is indicated when there is an important excess of spasticity in the proximal muscles (shoulder and elbow function). Its role is much less at the level of the wrist and fingers, especially if irreducible deformities in flexion are present.
2. For hyperspastic lower limb: Microsurgical DREZ-otomy produces a dramatic effect on tone. However, indications must be restricted to paraplegic patients with severe disability, uncomfortable in wheelchair, and/or exposed to pressure sores in bed or unable to walk.

Although technically demanding, the biggest advantage of DREZotomy over selective SDR is the one can do the procedure without neuromonitoring, which can be invaluable in a resource-constrained environment.

Conclusion

Management of severe spasticity is challenging. After failure of conservative management, patient can be offered neuromodulation in the form of intrathecal baclofen pump. However, due to cost and availability concerns, microsurgical DREZ-otomy can play an important in role in management of such cases and it can be safely performed simultaneously for bilateral upper and lower limb spasticity without neuromonitoring.

Conflict of Interest
None.

Financial Support
None.

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