

Conus Dorsal Root Entry Zone Rhizotomy for Lower Limb Spasticity

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Abstract

Rhizotomy is commonly performed for lower limb spasticity. However, it requires neuromonitoring, which may not be available in the majority of neurosurgical centers in developing countries. In addition, it involves cutting of the dorsal roots, which may lead to sensory symptoms in patients. Conus DREZ-otomy (dorsal root entry zone rhizotomy) is an attractive alternative as it does not require any neuromonitoring and does not entail destruction of any roots. However, a meticulous surgical technique is required for performing this procedure. In this article, we have described the operative technique of Conus DREZ-otomy performed by the senior author (D. A.).

Keywords

- conus DREZ-otomy
- spasticity

Introduction

Trauma is aptly labeled as “silent epidemic” as it is responsible for a significant amount of death and disability worldwide. There is a huge burden of patients suffering from trauma-induced disabling spasticity in developing countries like India. Physiotherapy and antispastic drug therapy continue to be major treatment options available worldwide.¹ Intrathecal baclofen pump is another option available for those who failed on conservative treatment. However, its availability and cost are always an issue. Selective dorsal rhizotomy (SDR) for treatment of lower limb spasticity in patients with cerebral palsy has become one of the most widely used surgical interventions for spasticity.^{1,2} However, it requires an extensive intraoperative neuromonitoring facility to perform the rhizotomy. This is a major concern in resource-constrained developing and third world countries. Therefore, dorsal root entry zone (DREZ) lesioning, as described by Sindou et al, that does not require an extensive intraoperative neuromonitoring facility can play a major role in the treatment of severe spasticity.³ Additionally, it provides symptomatic relief from chronic severe pain. DREZ lesioning disrupts the large 1a afferent centrally located tonigenic fibers of the dorsal roots and related circuitry of the ventral horn, contributing to spasticity. It can be used to alleviate spasticity in both upper and lower limbs.^{4,5} Conus dorsal root entry zone rhizotomy

(DREZ-otomy) is an attractive alternative for patients with severe, painful spasticity of lower limbs. In this article, we will illustrate the step-by-step operative technique of conus DREZ-otomy.

Operative Steps

1. Under general anesthesia, the patient is positioned prone on thoracic and iliac support.
2. The patient's head is placed 20 to 25 cm lower than the level of the surgical site to minimize perioperative cerebrospinal fluid (CSF) loss.
3. The desired vertebral level is identified using intraoperative C-arm or O-arm.
4. After painting and draping, a vertical midline skin incision is made from T11 to L2.
5. Bilateral laminectomy is performed from T12 to L1 or L2, with preservation of the spinous process.
6. Under an operating microscope, dura and arachnoid are opened longitudinally.
7. The filum terminale and conus medullaris are identified (► Fig. 1).
8. It is essential to identify the dorsal and ventral nerve roots. It is quite simple differentiating them visually. However, for those who are new to this procedure, neuromonitoring could be a safety net (► Fig. 2).

9. Sindou et al³ had suggested a continuous posterolateral sulcuotomy from L1 To S2 on each side to relieve spasticity. L1 and L2 nerve roots can be easily identified at their penetration into their respective dural sheaths, and the rough location of S1 and S2 segments is approximately 30 mm above the exit of the tiny coccygeal root from the conus (► Fig. 3).
10. Careful dissection is performed to cut all arachnid adhesions, thus freeing all rootlets and related vessels.
11. 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 are displaced dorsally and medially (► Fig. 4).
12. Then, a posterolateral sulcotomy (continuous incision) is performed from L1 to S2 bilaterally using microscissors (cuts must be 2 mm deep, with an angle of 45 degrees

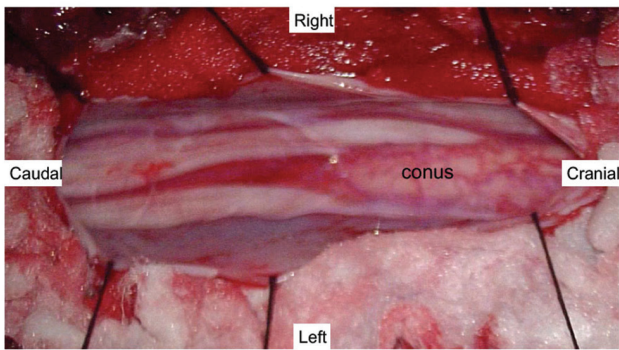


Fig. 1 Intraoperative photograph after opening of the dura at the desired spinal level followed by identification of the conus medullaris and filum terminale.

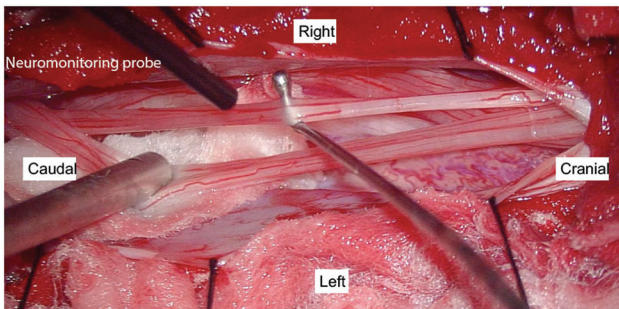


Fig. 2 Intraoperative photograph showing dorsal and ventral nerve roots.

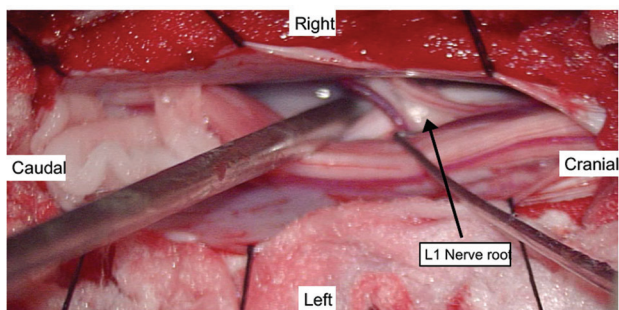


Fig. 3 Intraoperative photograph showing the L1 nerve root along with the radicular artery at its penetration into the dural sheath.

- ventrally and laterally) and fine tip bipolar coagulation, preserving the posterolateral spinal artery (► Fig. 5).
13. The borders of incision are spread slightly apart so that the gray-brown color of the most dorsal part of the dorsal horn (DH) may be seen using fine tip bipolar forceps (► Fig. 6).
14. Meticulous hemostasis is performed followed by dural closure using Prolene 5/0 suture (Ethicon, Somerville, New Jersey, United States) and laminoplasty (► Fig. 7).
15. The wound is closed in layers.

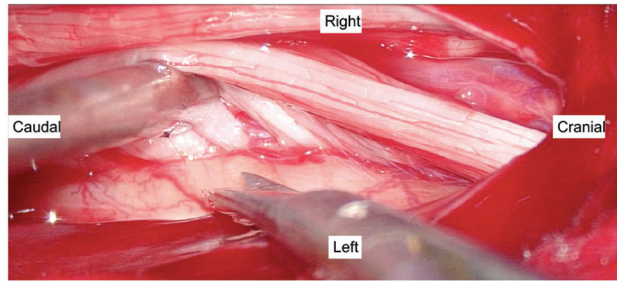


Fig. 4 Intraoperative photograph showing the lateral aspect of the dorsal root entry zone after the nerve roots are displaced dorsally and medially.

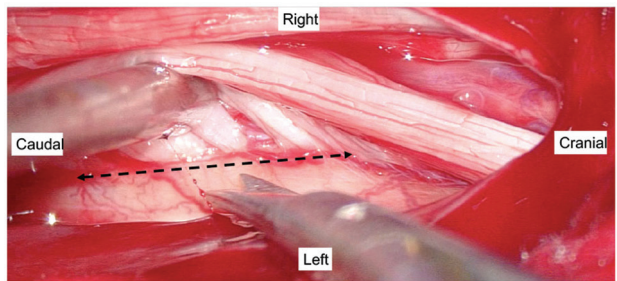


Fig. 5 Intraoperative photograph showing the intended incision line for posterolateral sulcotomy.

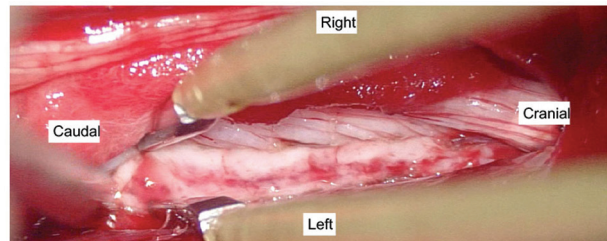


Fig. 6 Intraoperative photograph showing the completed posterolateral sulcotomy.

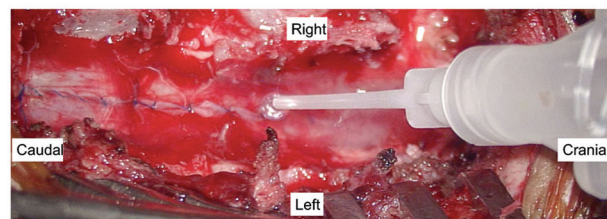


Fig. 7 Intraoperative photograph showing watertight dural closure supplemented by fibrin glue.

Operative Pearls and Nuances

- Adequate preoperative assessment of the patient should be performed, including its level of spasticity.
- There should be team assessment and coordination between the physiotherapist, neurosurgeon, orthopaedic surgeon, and rehabilitation team.
- Correct identification of the desired vertebral level is essential: intraoperative imaging.
- As the posterolateral spinal artery (0.1 to 0.5 mm in diameter) courses along the posterolateral sulcus, it should be preserved while freeing from the sulcus.
- Posterolateral sulcotomy should be continuous, as it is difficult to differentiate between roots carrying output to spastic muscles and roots innervating the muscles not related to harmful spasticity.
- Sulcotomy must be 2 mm deep, with an angle of 45 degrees ventrally and laterally with the use of fine-tip microscissors and bipolar cautery.
- Meticulous hemostasis should be performed to prevent postoperative arachnoiditis.
- Watertight dural closure should be performed with 5/0 or 6/0 Prolene or PDS suture (Ethicon).
- Aggressive postoperative care with physiotherapeutic measures should be taken for respiration and posturing in bed.
- If orthopaedic limitations did not regress sufficiently after DREZ-otomy and did not improve after manipulation and physiotherapy, orthopaedic surgery should be performed without delay.

Complications

- Postoperative CSF leak.
- Wound infection.
- Postoperative somatosensory deficits.
- Neurourological deterioration.
- Impairment of preserved urogenital anal function.

Funding

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Conflict of Interest

None declared.

References

- 1 Agrawal M, Samala R, Doddamani R, Agrawal D, Chandra SP. The role of selective dorsal rhizotomy in the management of post-traumatic spasticity: systematic review. *Neurosurg Rev* 2020 (e-pub ahead of print). Doi:10.1007/s10143-020-01255-w
- 2 Monaco BAD, Lopes AJM, Teixeira MJ. Ultrasound-guided DREZotomy: technical note. *Stereotact Funct Neurosurg* 2019; 97(2):127–131
- 3 Sindou M, Mertens P, Wael M. Microsurgical DREZotomy for pain due to spinal cord and/or cauda equina injuries: long-term results in a series of 44 patients. *Pain* 2001;92(1-2):159–171
- 4 Jeanmonod D, Sindou M. Somatosensory function following dorsal root entry zone lesions in patients with neurogenic pain or spasticity. *J Neurosurg* 1991;74(6):916–932
- 5 Agrawal D, Garg K. Microscissor DREZotomy - a new way for 'atraumatic lesioning' of DREZ. *Neurol India* 2019;67(5): 1320–1322