The Dawn and evolution of DREZ-lesioning for pain surgery

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INTRODUCTION:

In the late sixties (1965) the « Gate Control » theory drew neurosurgeons attention to the dorsal horn as an important level of pain modulation. Growing enthusiasm has led to target the dorsal horn of the spinal cord for non-invasive and invasive treatment modalities. Electrical stimulation was successfully used giving rise to the popular method of electrostimulation of the primary afferents to the spinal cord and also to surgical lesioning of the Dorsal Root Entry Zone (DREZ) surgery for very selected cases. In the Sindou’s thesis the DREZ region (Fig 1) was defined as the central portion of the dorsal rootlet including the medial part of the tract of Lissauer, and layers I to V of dorsal horn where the afferent fibers terminate and synapse (Fig 2).
METHODS: A pub med literature review since its conception in 1972 up to 2017 was performed made in order to summarize the different surgical technique modalities, including advances, trends and future perspectives.
**RESULTS:** The first attempts of DREZ lesioning were performed using microsurgical coagulations in 1972 at the University Neurological Hospital in Lyon by Marc Sindou. Soon after in 1976 Blaine Nashold from Duke University introduced the thermocoagulation technique as the lesion marker. Few years after, other techniques were proposed: including the laser beam by Powers et al. in 1988 and the ultrasound probe by Dreval in 1993. Intraoperative neuromonitoring can be used to make surgery in the DREZ more acute and safer. Pain after root avulsion, especially at the cervical or, less commonly, the lumbar –sacral region, and segmental pain after spinal cord/cauda equine injury are prominent indications.
**DISCUSSION:** Using microsurgical-lesioning techniques (microsurgical Drezotomy), or RF-thermocoagulation or ultrasound probe lesioning as the lesion-maker results in similarly good results, whereas a laser beam showed lesser efficacy, likely because its lesion does not reach the deeper dorsal horn layers.

Failures and recurrences were not found to be statistically correlated with time elapsed between injury and onset of pain or, surprisingly enough, with the duration of pain prior to surgery.

DREZ lesioning produced a more pronounced and complete effect on the paroxysmal than on the continuous pain component (63 vs 26%) (p=0.01) in the series of Ali et al, as well as in the senior series with a 10 years follow up (76.2 vs 43.1%). However the presence of a continuous background of pain must not be considered a contraindication for DREZ surgery.

**Clinical indications:**

Pain after root avulsion, especially at the cervical or, less commonly, the lumbar–sacral region, and segmental pain after spinal cord/cauda equine injury are prominent indications. For those
conditions SCS cannot be effective because of the degeneration of the corresponding dorsal column fibers up to the brainstem, and even more important, pain generators are located in the deafferented dorsal horn.

Pain after peripheral nerve lesions is a rare indication for DREZ surgery because SCS is generally effective. However, when SCS has failed and the main components are paroxysmal and/or allodynic, DREZ lesioning may be considered.

Initially designed for brachial plexus conditions such as Pancoast tumor and neuropathic pain due to brachial plexus avulsion, nowadays it is used in patients with sacral plexus avulsion, postherpetic neuralgia, spinal cord injury with and without paraplegia, in patients with breast cancer and cancerous involvement of the roots or post-radiotherapy lesions, patients with peripheral nerve lesions, multiple sclerosis and phantom limb.

*Electrophysiological Adjuvants*

Intraoperative direct spinal cord stimulation techniques to localize the dorsal root entry zone (DREZ) were described by Jeamonod et al in 1989. More recently in 2017 Son et al recommended Intraoperative
Neurophysiological Monitoring (Motor and Somatosensory Evoked Potentials) in Dorsal root Entry Zone lesioning to monitor and prevent some of the unwanted post-op complications.
**SUMMARY POINTS:** Although described several decades ago the DREZ lesioning technique is an evolving procedure, that continue to undergo modifications as the science and new surgical devices evolve.
**Fig 1:** Dr Sindou’s thesis in 1972 entitled: “Posterior Radiculo-medular junction study. The posterior selective radiculotomy for surgical treatment of pain”

**Fig 2:** Drawing depicting DREZ region defined as the central portion of the dorsal rootlet including the medial part of the tract of Lissauer, and layers I to V of dorsal horn where the afferent fibers terminate and synapse