

INTERVENTIONS FOR SPASTICITY

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Spasticity is an abnormal muscle hyperactivity seen in the patients with certain neurologic disorders. Exercises, orthoses, transcutaneous electrical nerve stimulation, extracorporeal shock wave therapy, repetitive peripheral magnetic stimulation, non-invasive brain stimulation, dry needling, intrathecal baclofen, whole-body vibration therapy, localized muscle vibration, botulinum toxin (BoTX) injection and neurolysis are used for the management of patients with spasticity. BoTX injection and neurolysis are the interventions commonly used in this regard. Intramuscular BoTX injection There are some issues that need to be clarified regarding intramuscular injection of BoTX. Some of them are about the proper muscle side and part into which toxin should be injected, and about the requirement of guidance and technique during the application. BoTX acts in the cytosol of the motor nerve terminal via inhibiting acetylcholine release from the presynaptic membrane of the neuromuscular junction (NMJ). It is only internalized from the presynaptic membranes of NMJ.¹ Therefore, the effect of BoTX injection on spasticity/dystonia largely depends on the amount of toxin transported to NMJs. NMJs in a skeletal muscle are generally clustered in one or more restricted areas defined as innervation zone(s) (IZs).

BoTX injections targeting this specific muscle areas are recommended to achieve an optimal therapeutic goal with lower doses and fewer side effects.² BoTX injections are performed blindly or using guides like electrical stimulation, electromyography (EMG) or ultrasound. Moreover, instrumented guidance of injection is strongly recommended for the treatment of spasticity/dystonia in both adults and children. Ultrasound guided BoTX injections seem to be superior to EMG in targeting the proper muscle and avoiding the neurovascular structures from injury.³ On the other hand, abnormal electrical signals from dystonic/spastic muscles can be recorded using EMG. This provides an advantage in the diagnostic stage to detect the involved muscles. IZ(s) of the skeletal muscles lie(s) perpendicular to the muscle fibers' alignment through which the distribution of BoTX diluted with saline is significantly restricted.⁴ Therefore, Kaymak et al.⁵ recommended the "seeding technique" to ensure that BoTX molecules are homogeneously distributed through the IZ, before they reach the other parts of the muscle which contain fewer or no NMJ. In summary, BoTX injections should be applied to the innervation zones using the seeding technique with the guidance of ultrasound.³ Neurolysis Phenol neurolysis to nerve trunk and/or intramuscular motor branches may result in greater spasticity reduction with longer effective duration, as compared to BoTX therapy. The possibility of long-term side effects, especially neuropathic pain following mixed nerve injections, needs to be considered.⁶ Selective peripheral neurolysis targeting motor nerve/branches with high frequency ultrasound was also recommended to decrease the side effects via protecting the sensory fibers of peripheral nerve from damage.⁷

Keywords: Spasticity, botulinum toxin, neurolysis

References

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