Peripheral nerve injury treatment

Given the fact that neurologists frequently evaluate patients with these conditions and refer patients to neurosurgeons, it is important for them to be aware of the indications for, types, and timing of surgical procedures, and expected outcomes with the various types of interventions [1).

In deciding when to repair a peripheral nerve injury , the surgeon must define: (1) when the time for useful recovery by spontaneous regeneration has passed, and (2) the elapsed time when a nerve repair has little to offer. When the duration of total muscle denervation exceeds 24 months ("24-month rule"), most muscles are subject to relatively severe time limitations for the return of useful function. This is less likely to be so for large bulky muscles, such as biceps and gastrocnemius-soleus, than for smaller muscles, such as those of the forearm and hand. An exception to this guideline are the facial muscles which, although relatively small, may benefit from late reinnervation by facial nerve repair or neurotization procedures.

Other exceptions to the "24-month rule" may occur in a few lesions that have maintained some nerve fiber continuity. If some fibers traverse the lesion, even though their number is insufficient to produce useful function distally, they may promote distal stump architecture preservation. Very late repair after resection of the lesion in continuity can occasionally produce function.

Nerve transfer is a useful reconstructive technique for proximal nerve injury.

Maggiore et al. developed tissue engineered nerve grafts (TENGs) featuring long, aligned axonal tracts from Dorsal root ganglion (DRG) neurons that are fabricated in custom bioreactors using the process of axon "stretch-growth". They have shown that TENGs effectively serve as "living scaffolds" to promote regeneration across segmental nerve defects by exploiting the newfound mechanism of axon-facilitated axon regeneration, or "AFAR", by simultaneously providing haptic and neurotrophic support. To extend this work, the current study investigated the efficacy of living versus non-living regenerative scaffolds in preserving host sensory and motor neuronal health following nerve repair. Rats were assigned across five groups: naïve, or repair using autograft, nerve guidance tube (NGT) with collagen, NGT + non-aligned DRG populations in collagen, or TENGs. We found that TENG repairs yielded equivalent regenerative capacity as autograft repairs based on preserved health of host spinal cord motor neurons and acute Axon regeneration, whereas NGT repairs or DRG neurons within an NGT exhibited reduced motor neuron preservation and diminished regenerative capacity. These acute regenerative benefits ultimately resulted in enhanced levels of functional recovery in animals receiving TENGs, at levels matching those attained by autografts. The findings indicate that TENGs may preserve host spinal cord motor neuron health and regenerative capacity without sacrificing an otherwise uninjured nerve (as in the case of the autograft), and therefore represent a promising alternative strategy for neurosurgical repair following Peripheral nerve injury (PNI) [2).

Peripheral nerve injury stem cell therapy

see Peripheral nerve injury stem cell therapy.

Electrostimulation

Electrical stimulation for peripheral nerve injury treatment.

References

[1]
Jack MM, Smith BW, Spinner RJ. Neurosurgery for the Neurologist: Peripheral Nerve Injury and Compression (What can be Fixed?). Neurol Clin. 2022 May;40(2):283-295. doi: 10.1016/j.ncl.2021.11.001. Epub 2022 Mar 31. PMID: 35465875.
[2]
Maggiore JC, Burrell JC, Browne KD, Katiyar KS, Laimo FA, Ali ZS, Kaplan HM, Rosen JM, Cullen DK. Tissue Engineered Axon-Based "Living Scaffolds" Promote Survival of Spinal Cord Motor Neurons Following Peripheral Nerve Repair. J Tissue Eng Regen Med. 2020 Oct 13. doi: 10.1002/term.3145. Epub ahead of print. PMID: 33049797.