Nerve repair by end-to-side nerve coaptation: histologic and morphometric evaluation of axonal origin in a rat sciatic nerve model

Kirsten Haastert, Holger Joswig, Katharina Jäschke, Madjid Samii & Claudia Grothe

OBJECTIVE:
We compared the origin and quality of regenerating myelinated axons after end-to-side neurorrhaphy or end-to-end neurorrhaphy.

METHODS:
Transected adult rat tibial nerves were either end-to-end coapted or the distal stump was sutured to a perineurial window of the fibular nerve. Electromyographic recordings from the gastrocnemius muscle 8 weeks later revealed reinnervation by tibial nerve axons. Retrograde tracing of neurons projecting across the coaptation sites was performed with Dil for the tibial nerve and FluoroGold for the fibular nerve to reveal the origin of regenerating axons. Orientation of regenerating axons was demonstrated by immunohistochemical staining of the coaptation sites. Nerve cross-sections proximal and distal to the coaptation sites were evaluated regarding quality and quantity of myelinated axons inside the donor and acceptor nerves in comparison to nonoperated nerve samples.

RESULTS:
Compound muscle action potential responses were not different 8 weeks after end-to-side as compared with end-to-end coaptation. Double fluorescence of spinal motoneurons (L4-L6) and dorsal root ganglion neurons (L4-L6) elucidated events of collateral sprouting of sensory and motor donor axons. Morphometric analysis demonstrated significantly higher numbers of regenerated myelinated axons distal to end-to-end as distal to end-to-side repair. Furthermore, events of axonal sprouting in the donor nerve proximal to the end-to-side coaptation site were discovered. However, with quantitative parameters such as fiber density and g-ratio, no impairment of the donor nerve was evident.

CONCLUSION:
The current study supports the hypothesis that end-to-side neurorrhaphy represents an opportunity for peripheral nerve repair when a proximal nerve stump is not available.
end-to-side nerve coaptation
journal paper/review (English)
1-3-2010
Neurosurgery