

An experimental study of the electromyographic assessment of peripheral nerve regeneration after end-to-side neurorrhaphy

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Abstract

Background. Peripheral nerve lesions have an incidence of 2-3% of all traumas and represent a significant clinical and social problem because patients frequently require several reconstruction operations, whose effect is often non-satisfactory. In certain cases, direct end-to-end neurorrhaphy is impossible post-traumatically, when there is a lack of nerve substance or when the proximal stump is inaccessible. A solution for the treatment of these cases is end-to-side neurorrhaphy, which represents a viable alternative to nerve graft, i.e. another method for the treatment of peripheral nerves.

Aims. In this stage of the research, an original experimental method was used, consisting of the end-to-side neurorrhaphy of the rat sciatic nerve, after section and suture. The aim was to determine whether this method could be a viable alternative to end-to-end neurorrhaphy, whether the epineural window influenced the regeneration process, the viability of regeneration in the distal segment of the nerve and the functional and morphologic changes, quantitatively and qualitatively.

Methods. This study aimed at investigating the regeneration of peripheral nerve in the rat after injury and termino-lateral neurorrhaphy by using the electromyographic method. At 16 weeks postoperatively, the animals were re-anesthetized, with the exposure of the sciatic nerve and the gastrocnemius muscle, both in the operated posterior limb and the healthy posterior limb, for the electromyographic study. The latency and amplitude of the compound muscle action potential were determined both in the operated posterior limb and the normal posterior limb. The experiment included 75 rats equally distributed in 3 groups of 25 rats each. In all cases, after the exposure of the sciatic nerve, this was sectioned at about 1.2 cm proximal to its trifurcation. In the first two groups A and B, repair was performed by end-to-side neurorrhaphy, without/with an epineural window, respectively, and in the third group, which was the control group – group C, conventional end-to-end neurorrhaphy was performed.

Results. The recovery after termino-lateral neurorrhaphy is possible and this can be explained through fibers regeneration from the lateral side of the “donor” nerve to the transected stump of the “receptor” nerve. The best results of electromyographic evaluation in terms of both the compound muscle action potential amplitude and latency were found in group C, with the end-to-end suture of the sciatic nerve.

According to the ANOVA statistical analysis, followed by the application of a post-hoc test with the Bonferroni correction for the comparisons between the three studied groups, a statistically significant difference between group C compared to groups A and B was evidenced both regarding the compound muscle action potential amplitude and latency. However, there was no statistically significant difference between groups A and B regarding the compound muscle action potential amplitude and latency. This shows that the epineural window did not significantly influence the regeneration process, even if results were better in the group with an epineural window compared to that without an epineural window.

Conclusions. In peripheral nerve lesions with proximal nerve stump unaviable or in great nerve defects, which cannot be repaired with termino-terminal neurorrhaphy or nerve graft, termino-lateral neurorrhaphy is a viable alternative.

Keywords: end-to-side neurorrhaphy, nerve regeneration, electromyographic evaluation, alternative methods for surgical nerve repair, injury in sport