

An experimental study of the histomorphometric 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 and the results are 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 end-to-side neurorrhaphy of the rat sciatic nerve, after section and suture. The aim was to determine whether this method can be a viable alternative to end-to-end neurorrhaphy, whether the epineural window influences 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 is concerned with the clinical investigation of the regeneration of the peripheral nerve in the rat after injury and termino-lateral neurorrhaphy by using the histomorphometric method, which evaluates the number of fibers/mm², the mean diameter of fibers, the thickness of the myelin sheath and the macroscopic nerve changes at the level of the suture. 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, repair was performed by end-to-side neurorrhaphy, without/with an epineural window, respectively, and in the third group, which was the control group, conventional end-to-end neurorrhaphy was performed.

Results. The recovery after termino-lateral neurorrhaphy is possible and this can be explained through the fiber regeneration from the lateral side of the “donor” nerve to the transected stump of the “receptor” nerve. The best results of histomorphometric evaluation regarding the mean number of fibers/mm², the diameter of fibers and the thickness of the myelin sheath were found in group C, with the end-to-end suture of the sciatic nerve. The poorest results were evidenced in group A, with an end-to-side suture without an epineural window. The degree of fibrosis assessed macroscopically was the highest in group B and the lowest in group C. The ANOVA test, followed by multiple Bonferroni comparisons for the performance of comparisons between the three groups evidenced significant differences between group C compared to groups A and B. No statistically significant difference was found between groups A and B.

Conclusions. In peripheral nerve lesions with proximal nerve stump unavailable 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, histomorphometric evaluation, alternative methods for surgical nerve repair, injury in sport.