Un nuovo metodo per la stima del blocco di conduzione

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(Article begins on next page)
1. INTRODUCTION

The determination of conduction block - CB (i.e., the failure of an action potential to propagate through an intact axon) can rely on the comparison between the compound muscle nerve action potentials (CMAP) following stimulation at sites proximal and distal to the region in which a block is suspected. A reduction of the amplitude or of the area of the CMAP following proximal versus distal stimulation is an accepted indication of conduction block in clinical practice. Nerve and muscle conduction velocity spread determines a temporal dispersion of the motor unit action potentials (MUAP) constituting a CMAP; as a consequence, phase cancellation can occur in the MUAPs which add up in the detected CMAP. CMAP amplitude and area are strongly affected by temporal dispersion of the MUAPs (Olney et al., 2003). The aims of this study is the development of a novel method for the estimation of motor nerve conduction block which is insensitive to temporal dispersion.

2. METHODS

A CMAP is considered as the convolution of a representative MUAP (referred to as the Kernel) with a delay distribution.

The new method for the estimation of conduction block is based on the deconvolution (by Tichonov method) of both distal and proximal CMAP, using the same kernel. It provides an approximate reconstruction of the distally and proximally elicited CMAP. The kernel is chosen in order to minimise the reconstruction error. The integral of the delay distribution is considered as an estimate of the number of active motor units, and is used to estimate conduction block.

3. RESULTS

The new method was applied to simulated and experimental signals. Two types of simulated signals were considered.

Phenomenological signals: convolution of a representative MUAP (extracted from abductor pollicis muscle) and a delay distribution (obtained from the velocity dispersion and the conduction distance). Same approach of Rhee et al. 1990, but with a representative MUAP extracted from a human muscle.

Experimental signals: from abductor digiti minimi, after supramaximal stimulation at the wrist, below the elbow and above the elbow, using the bipolar recording technique routinely employed in clinical neurophysiology. Different temporal dispersions were obtained when comparing above-elbow stimulation with below-elbow stimulation (conduction distance of about 10 cm) or with wrist stimulation (conduction distance of about 35 cm).

4. References


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