Characteristic of the Regional Microcirculation of the Ulnar Nerve with Ulnar Nerve Dysfunction

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Summary

Edema of the ulnar nerve is important imaging sign in throwers with medial elbow pain, however pathophysiology of the edema of the ulnar nerve reminds unclear. The purpose of this study is characteristics of regional microcirculation of the ulnar nerve in individuals with the ulnar nerve dysfunction. The regional microcirculation of the ulnar nerve during flow-mediated vasodilation test was assessed using NIRS.The velocity of change in Hb after decompression was compared between ulnar nerve dysfunction and control groups. The velocity of change in HHb in the ulnar nerve dysfunction was significantly lower than in control. It might indicate initial changes in the blood-nerve barrier in vivo with chronic mechanical stress in human peripheral nerve.

Introduction

Entrapment neuropathy of the ulnar nerve at the elbow is one of the causes of medial elbow pain in throwing athletes. Recently, ultrasound imaging has been used to assess ulnar nerve dysfunction. An increase in the cross-sectional area of the ulnar nerve around the elbow was found in throwers with medial elbow pain [1]. These results are considered indicative of congestion of the ulnar nerve [2], although it is unclear whether congestion of the ulnar nerve occurred in the subjects with ulnar nerve dysfunction. In addition, NIRS can be used to examine the regional microcirculation of the ulnar nerve for a relationship between nerve dysfunction and vascular function during the applied flow-mediated vasodilation test (FMV). The purpose of this study is characteristics of regional microcirculation of the ulnar nerve in individuals with the ulnar nerve dysfunction.

Methods

Eleven elbows of 11persons with medial elbow pain in ulnar nerve stretching test (UND group) and 11 age matched control elbows (control group) were participated in this study. Exclusion criteria were defined as having a history of any surgical procedure in the upper limb, subject could not perform the test with any pain and fear, and did not recognize the ulnar nerve deeper than 1cm under the cubital tunnel.

The regional microcirculation of the ulnar nerve under the cubital tunnel was recorded with the elbow flexed at 90 degrees using a NIRS system (Oxy pro, sensor distance;3cm) with 1Hz. Oxygenated hemoglobin (O_2Hb), and deoxygenated hemoglobin (HHb) were measured during the FMV, in which the upper arm was compressed using the manchette with 5-minutes until no radial artery pulsation was detected after a 3-minute rest period and while the manchette was rapidly decompressed. In each subject, the mean value of each hemoglobin (Hb) for 3 min at rest was used as the reference, and the velocity of change in Hb during decompression was calculated from the Hb after 5 min of compression and the peak Hb within 1-minute after decompression.

The velocity of change in each Hb was compared between the UND and control group using unpaired t-test.

Results and Discussion

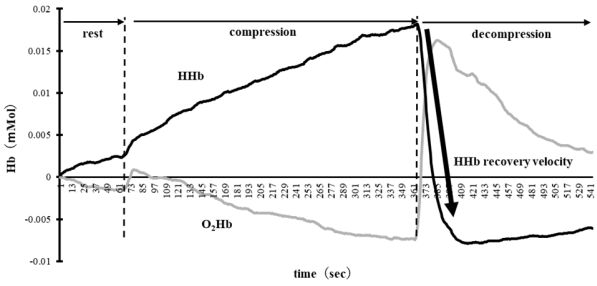

Figure1 The change of O_2Hb and HHb during FMV

In both the UND and control groups, O_2Hb progressively decreased and HHb progressively increased with compression. After decompression, O_2Hb increased rapidly and HHb decreased rapidly (Fig.1). The velocity of change in HHb in the UND group (-0.04 ± 0.03 mM/s) was significantly lower than in the control group (-0.07 ± 0.06 mM/s) ($p<0.05$), although the velocity of change in O_2Hb did not differ significantly between the two groups (UND; 0.08 ± 0.06 mM/s, control;0.08 ± 0.09 mM/s) (p=0.98). The FMV test confirms the vasodilatory response to decompression after compression. The vasodilation improves the regional microcirculation, increases the O2Hb and decreases the HHb, thus increasing the oxygen supply to the tissues. In the UND group, the decrease in the velocity of change in HHb was indicative of impairments of regional microcirculation, which is mainly in the venous system. Previous studies in animal models of entrapment neuropathy have shown the initial changes were a breakdown in the blood nerve barrier, followed by subperineurial edema and fibrosis; localized, then diffuse, demyelination occurred, and finally Wallerian degeneration [2]. Therefore, decreases in the velocity of change in HHb after compression in UND might indicate initial changes in the blood-nerve barrier *in vivo* with chronic mechanical stress in human peripheral nerve.

Conclusions

The regional microcirculation of the ulnar nerve is impaired in individuals with minor ulnar nerve dysfunction.

References

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