

大腿四頭筋の反射機能異常が予測外の着地動作中の 下肢筋の応答様式に与える影響

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The Effect of Prolonged Vibration Stimulation to the Quadriceps Femoris of Normal Healthy Subjects on Reflex Pattern of Thigh Muscles during Surprised Landing

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ABSTRACT

Quadriceps femoris (QF) muscle weakness is especially common after knee joint injury and occurs due to both muscle atrophy and deficits in voluntary activation. An important cause of QF voluntary activation deficits is arthrogenic muscle inhibition (AMI). In present study, neurological changes of the QF induced by prolonged vibration stimulation was used as a model of the AMI. This is because neurological changes led by prolonged vibration stimulation were similar to that observed in the QF with the AMI. The purpose of present study is to investigate how the neurological abnormality would affect to reflex activities of thigh muscles during unexpected landing. The prolonged vibration stimulation significantly enhanced the average EMG during time frame of the middle latency reflex (MLR) of the vastus lateralis

(VL) and the biceps femoris (BF) only after the surprised landing even though no alternation of the MLR of the VL and the BF in both normal landings were found even after the application of prolonged vibration stimulation. These results suggested that neurological alternations lead by the prolonged vibration stimulation have no effect on landings accomplished by accurate feedforwarded information from brain based on visual estimation. However, only when discrepancy was recognized between the feedforward from brain and feedback from the proprioceptors in the lower limbs, the MLRs of the VL and BF were enhanced. The mechanism of the enhancement of the MLR via the attenuated afferents from proprioceptors to their brain might work as a preparatory mechanism in case startle events were imposed to them. In other words, in advance, a human brain might produce neurophysiological state in which the MLR could easily be enhanced via disinhibited Ib interneurons as a compensatory strategy to prepare startle events.

要 旨

膝関節での様々な病変により、大腿四頭筋 (QF) の機能が特異的に低下することが知られている。この筋機能低下は *Arthogeneous Muscle Inhibition* と呼ばれ、多くの研究がなされてきた。この筋機能低下は様々な病態の患者に現れ、リハビリテーションを遂行する上で AMI を克服することは極めて重要な課題である。一方、AMI 研究では、既に病態を有する被験者を用いなければならず、被験者内での比較が困難である。ところが、近年、筋への長時間振動刺激により惹起される筋機能変化が AMI 起因の神経系変化と類似していると報告されている。本研究では、長時間振動刺激を用い、健常者の QF に AMI に類似した筋機能低下を誘発し、サプライズランディング (SL) 中の下肢筋の応答様式を刺激前後で比較を行い、AMI が外乱に及ぼす影響を明らかにすることを目的とした。その結果、長時間振動刺激が SL 中の外側広筋と大腿二頭筋の中潜時域の筋放電を有意に大きくすることが分かった。