Electrophysiological properties of dorsal root ganglion neurons in vivo in a derangement rat model of osteoarthritis

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ABSTRACT

Osteoarthritis (OA) is the most common form of arthritis, and pain is a primary symptom, especially during normal range movement of affected joints. Currently, there is not an effective mechanism-based treatment for OA pain. This study on the primary sensory neurons is designed to determine the nature of OA pain, whether inflammatory or neuropathic pain.

METHODS

In vivo intracellular recording set-up

RESULTS

Electrophysiological changes: Aδ and C neurons in inflammatory models vs. all sizes of neurons in neuropathic models

Sensory neuron classification

METHODS

Figs 1-3: A LTM: A type low threshold mechanoreceptors; G/F: G hair/Field neurons; RA: rapid adaptation neurons including Pacinian neurons and Glabrous rapid adaptation neurons; SA: slow adaptation neurons; MS: muscle spindle neurons. A LTM group is the pooled group of all the low threshold neuronal subgroups (G/F, RA, SA, MS). Fig 4: MS neurons are the most affected neuronal subgroup among all the A LMTs. Significant changes were identified on the repolarization phase.

Large Aβ neurons undergo significant electrophysiological changes in this derangement rat model of OA

Aδ LTM and HTM show changes in different phases of the AP — in Aβ LTM, changes are related mostly to the repolarization phase; in Aβ HTM, changes are related mostly to the depolarization phase.

No significant changes are identified in unresponsive neurons, which implies an insignificant role of the activation of knee joint afferents.

CONCLUSIONS

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Fig 5: unresponsive neurons are those that are unresponsive to any of the mechanical stimuli, including neurons with inaccessible receptive fields. The only significant finding is that Vm in A type neurons was more depolarized in OA rats.

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Fig 8: All C and Aβ neurons were classified by their conduction velocities regardless of their sensory properties. No statistical difference was identified between OA and naive rats, except that Vm was more depolarized Aβ neurons in OA rats.