ABSTRACT

Mechanosensitive (MS) ion channels are present in a variety of cells. However, very little is known about the ion channels that account for mechanical sensitivity in sensory neurons. We identified the two most-frequently encountered but distinct types of MS channels in 1,390 out of 2,962 membrane patches tested in cultured dorsal root ganglion neurons. The two MS channels exhibited different thresholds, thus named as low-threshold (LT) and high-threshold (HT) MS channels, and sensitivity to pressure. The two channels retained different single-channel conductances and current-voltage relationships: LT and HT channels elicited large and small channel conductance with outwardly-rectifying and linear I-V relationships, respectively. Both LT and HT MS channels were permeable to monovalent cations and Ca\(^{2+}\), and were blocked by gadolinium, a blocker of MS channels. Colchicine and cytochalasin D markedly reduced the activities of the two MS channels, indicating that cytoskeletal elements support the mechanosensitivity. Both types of MS channels were found primarily in small sensory neurons with diameters of < 30 \(\mu\)m. Furthermore, HT MS channels were sensitized by a well-known inducer of mechanical hyperalgesia, prostaglandin E\(_2\), via the protein kinase A pathway.
We identified two distinct types of MS channels in sensory neurons that probably give rise to the observed mechanosensitive whole-cell currents and transduce mechanical stimuli to neural signals involved in somatosensation including pain.

Key words: mechanosensitive channels, cationic, sensory neurons, somatosensation, pain, sensitization

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