Sodium current properties differ in neonate and adult mouse superficial dorsal horn neurons

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Superficial dorsal horn (SDH: laminae I-II) neurons are important for spinal processing of nociceptive information and their excitability is determined, in part, by the properties of voltage-gated sodium channels (I_{Na}). Recently, we have shown excitability and action potential (AP) properties in SDH neurons are altered during development (Walsh *et al.*, 2009).

Purpose: To compare I_{Na} currents in neonate (P0-5) and adult (≥ P21) SDH neurons.

Methods: Mice were anaesthetized (Ketamine 100 mg/kg i.p.) and decapitated. Transverse slices were prepared from L3-5 spinal segments and whole-cell recordings were made (at 32°C) from visualized SDH neurons using a CsF-based internal.

Results: A fast activating and inactivating inward current was evoked by depolarising neurons from −60 to −20 mV. The peak amplitude of this current increased during development (1.34 ± 0.35 nA *vs* 6.58 ± 0.68 nA; neonates (n = 10) *vs* adults (n = 12)), and was completely abolished by 1 μM TTX in both neonates (n = 2) and adults (n = 3), thus confirming the current was mediated by I_{Na}. Time to peak and half width was slower in neonates (0.82 ± 0.08 ms *vs* 0.46 ± 0.06 ms; 1.40 ± 0.25 ms *vs* 0.43 ± 0.05 ms). I_{Na} activation voltage and peak current voltage also differed in neonatal and adult neurons (−50 mV *vs* −60 mV; −15 mV *vs* −25 mV).

Conclusion: These data show I_{Na} expression and kinetics differ in neonate and adult SDH neurons and provide an underlying mechanism for the differences observed previously in AP properties of developing SDH neurons.

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