Differential cortical representation of inputs arising from the upper arm

D.K. Chelvanayagam, S.S. Nagi and D.A. Mahns, School of Medicine, University of Western Sydney, NSW 1797, Australia.

Purpose: Peripherally-induced pain has a range of qualities that depend on the tissue stimulated. Cutaneous pain is often described as a sharp and/or burning, well-localised sensation, whereas muscle pain has a dull-aching quality that is poorly localised. Intriguingly, bone pain shares qualities of cutaneous and muscle pain.

Methods: Three 21-element platinum electrode arrays (provided by Cochlear Ltd.) were used to record the responses of the primary somatosensory cortex to electrical stimulation of the median nerve, the nerve innervating the triceps and/ or biceps muscles and the bone nerve entering the nutrient foramen of the humerus in anaesthetised rabbits ($70mg.kg^{-1}$ α-chloralose, n=5). Electrical stimuli (1mA, 2ms) were applied to each nerve at an inter stimulus interval of ~2s.

Results: Cortical representation of bone and muscle inputs was contained within an area identified by stimulation of the median nerve. The positive-going cortical potentials tended to cluster on electrodes around distinct loci. The amplitude and extent of cortical activation varied between inputs from bone and muscle nerves relative to the median nerve (latency 13ms, amplitude 750μV). Bone-evoked cortical responses were observed in the majority of active recording electrodes identified by stimulating the median nerve and were of comparable amplitude but of longer latency (14ms). In contrast, stimulation of the muscle nerve either failed to evoke a cortical response or evoked responses but on fewer electrodes. Furthermore, the responses were of smaller amplitude and longer latency (17ms).

Conclusion: Consistent with perceptual differences experienced during muscle and bone pain, a more limited pattern of cortical activation was observed following muscle stimulation.