

Volatile vs injectable anaesthetics: considerations for electrophysiological studies in the rat

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Nerve excitability testing (NET) is a reproducible and reliable means of testing axonal ion channel function and membrane potential in clinical settings. The use of this technique in rodent models of disease provides an attractive translational methodology. Unlike in humans, anaesthetics are required in animal research, therefore, systematically examining the effects of different anaesthetics is important for the implementation of this technique. Isoflurane and ketamine/xylazine are widely used in experimental settings, however, their effects on NET are unclear. NET was performed on the rat ulnar nerve after administration of either isoflurane by inhalation or ketamine/xylazine by intraperitoneal injection, using a cross over design (n=12). Comparing the ulnar NET results obtained under these two anaesthetic agents revealed multiple significant differences in various parameters. There was a significant difference between the two anaesthetic agents in the threshold electrotonus parameters TEd(90-100ms), $P=0.016$ and TEh(overshoot), $P=0.005$. Additionally, significant differences were revealed in the subexcitability parameter ($P<0.001$) of the recovery cycle. Moreover, consistency was demonstrated in both types of anaesthetics throughout all nerve excitability parameters. Overall, this study has the potential to reveal the effects of anaesthetic agents on axonal ion channel function and membrane potential. These results demonstrate that different anaesthetics have different effects on motor excitability properties and should be considered before performing NET in animal models. This study also has the potential to identify the optimal agent to use for improved translatability of nerve excitability testing.