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ScienceDirect
Journal of Experimental Animal Science 43 (2007) 255–264
Journal of Experimental Animal Science
www.elsevier.de/jeas

Partially antagonisable anaesthesia of the small hedgehog tenrec (*Echinops telfairi*) with medetomidine, midazolam and ketamine

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Abstract

It was purpose of this study to establish a safe and stable anaesthesia for the small hedgehog tenrec (*Echinops telfairi*) which can be used for short- and long-time interventions.

Therefore 29 small hedgehog tenrecs were anaesthetized between 30 min and 4.5 h with a combination of the α_2-agonist medetomidine (0.2 mg/kg), the benzodiazepine midazolam (3 mg/kg) and the dissociative anaesthetic ketamine (20 mg/kg) (MMK). All injections were administered subcutaneously (SC) in the area of the back by carefully lifting the animal's quills with a forceps. After SC injection of MMK animals lost their righting reflexes after 3.6 min ($\pm$1.12). Oxygen was supplemented to the animals' nose and their body temperature was maintained constantly at 30 °C by a heating plate.

Values of respiratory rate, pulse rate and oxygen saturation during the experiment were statistically evaluated by ANOVA and post-hoc tests to a level of significance determined as 5%.

The animals had stable cardiovascular and respiratory values and good muscle relaxation.

Between the 15th and the 45th minute the level of anaesthesia was deep enough for surgical interventions. Respiratory rate in this phase was 29.6$\pm$8.1 breaths/min and pulse rate was about 81.9$\pm$20 beats/min.

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0939-8600/$ - see front matter
doi:10.1016/j.jeas.2006.09.003

MMK was partially antagonised with a combination of atipamezole (1 mg/kg) and flumazenile (0.2 mg/kg) (AF) SC. Time of complete recovery took about 8.8 min (8.76 ± 4.31 min) after administering the antagonists.

The partially antagonisable combination of MMK produced a stable anaesthesia in small hedgehog tenrecs up to 4.5 h. Therefore MMK can be used for short time interventions as well as e.g. for long-lasting neurophysiological recordings, when animals should survive the trials.

Keywords: Tenrec; *Echinops telfairi*; Anaesthesia; Medetomidine; Midazolam; Ketamine; Neurophysiological recordings

Introduction

The small hedgehog tenrec (*Echinops telfairi*) belongs to the newly established order Afrosoricida (Stanhope et al., 1998a, b; Robinson and Seiffert, 2004), and is a semiarboreal species endemic for Madagascar. Phenotypically, the tenrec resembles the European hedgehog (*Erinaceus europaeus*) and the African hedgehog (*Atelerix albiventris*). *Echinops telfairi* is a nocturnal insect hunter, and falls in a state of torpor during winter of the southern hemisphere from May to September. It retained many conservative features, including the retention of a cloaca, testes not descending during maturation and an unstable thermoregulation, only partly endogenously controlled (Kupitz, 2000).

Among living mammals, *Echinops telfairi* has one of the lowest neoencephalization indices (Stephan et al., 1970, 1991). Its brain therefore resembles those of mammals already extinct 75–80 million years ago (Kielan-Jaworowska, 1984; Jerison, 1990). Representing an archaic state of neocortical development renders this tenrec very interesting to research on evolutionary aspects of cortical systems, especially the neocortex and its connections.

For this purpose, areas of the neocortex have to be characterized functionally by electrophysiological recording methods with subsequent injection of tracers to determine afferent and efferent connections (Krubitzer et al., 1997). Comparison of functional and connectional features can help to assess general principles of organisation and potential mechanisms of modification during the evolution of the neocortex.

A precondition for valid electrophysiological investigations is a stable anaesthesia with sufficient analgesia during surgery of the skull and subsequent electrophysiological recording. Anaesthesia should influence the neural activity as little as possible, and should be without major side-effects over several hours. Moreover, anaesthesia may not interfere with cardio-respiratory functions of the tenrec and the animals should recover very fast.

According to literature, tenrecs have been anaesthetized for surgical procedures and recording experiments with a variety of anaesthetics and various methods:

Krubitzer et al. (1997) administered 0.5–1.8 mg/kg ketamine IM and 0.5–0.8 mg/kg xylazine IM for surgical anaesthesia, and maintained the surgical stage as necessary with half of the initial dose, given subcutaneously (SC). The authors could perform neurophysiological recordings up to 15 h, however animals were euthanized at the end of the trials. Therefore nothing is known whether recovery would have been possible.