J. Pharm Pharmacol. 1990, 42: 672
Communicated May 16, 1990

Letter to the Editor

Ketamine as an anaesthetic in dogs

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We (Huyghens et al 1987) reported in this journal on the influence of cardiopulmonary resuscitation on the pharmacokinetics of nimodipine in the dog. The experiments were performed under anaesthesia with ketamine and muscle paralysis with gallamine. This anaesthesia had been used in a study on the blood flow in the cerebral cortex during cardiac resuscitation in dogs (Jackson et al 1984), and was chosen because we also planned cerebral blood flow studies after cardiopulmonary resuscitation. We are now concerned about the anaesthesia we used since, when following up our work we learnt that ethics committees in the USA no longer accept the use of ketamine as sole anaesthetic for surgical purposes in the dog because it is difficult to judge the adequacy of anaesthesia, especially with muscle paralysis. We therefore would like to provide additional information on the anaesthetic protocol we used and to draw the attention of other investigators to this potential problem.

Like Jackson et al (1984) we induced anaesthesia with an i.v. bolus injection of 7 mg kg^{-1} ketamine and gave gallamine as an i.v. bolus injection of 1 mg kg^{-1} to control ketamine-induced muscle rigidity and spontaneous muscle activity. Details on the maintenance of anaesthesia were not mentioned by Jackson et al; in our experiments, anaesthesia was maintained by means of an infusion pump to be sure that it was continuous, and started at a rate of 0·2 mg kg^{-1} min^{-1} ketamine and 0·01 mg kg^{-1} min^{-1} gallamine. Since a muscle relaxant was used with an anaesthetic agent, and as advised by the guidelines of the Journal of Physiology (Journal of Physiology 1989), we continuously monitored changes in heart rate and arterial blood pressure to judge the adequacy of the anaesthesia. If the arterial blood pressure started to fluctuate or if the animals showed voluntary or stimulation-induced movements, the infusion rate was increased; this was not mentioned in our publication.

After we were alerted to the possible shortcomings of ketamine anaesthesia in dogs, we examined the literature. In experimental work on resuscitation, Salerno et al (1987) also used ketamine anaesthesia together with muscle paralysis but in combination with diazepam pretreatment in a protocol approved by their ethics committee. However, we have been in contact with Dr Blaine C. White, a co-author of the paper of Jackson et al (1984) who told us that the use of ketamine as sole anaesthetic is no longer permitted by the ethics committee associated with his group because of concern in the veterinarian literature whether this dissociative type of anaesthesia should be used alone in the dog.

We have calculated the ketamine plasma concentrations that could be expected with the dosing regimen of ketamine we used, using the pharmacokinetic data of Kaka & Hayton (1980). These calculations suggest that we probably achieved a steady-state plasma concentration of ketamine (4–6 $\mu g\ mL^{-1}$) above the estimated surgical anaesthesia level (3 $\mu g\ mL^{-1}$). However, literature data concerning estimated surgical anaesthesia levels of ketamine in clinical medicine in dogs (Wright 1982; Haskins et al 1985; Muir & Hubbell 1988) are difficult to interpret; the use of ketamine alone has been found an unsatisfactory anaesthetic for surgical purposes mainly because of extreme muscle tone and emergence reactions.

In conclusion, in view of these doubts about the use of ketamine anaesthesia in the dog we would not advocate the use of the protocol we published in this journal. Ketamine should be used in combination with other general anaesthetics (e.g. an inhalational anaesthetic such as halothane) (White et al 1982).

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Journal of Physiology (1989) Notice to contributors 408: V-XVI

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